The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

BOUVERIE HOUSE, 154, FLEET STREET, LONDON, E.C.4

Telegrams : ALLANGAS FLEET LONDON
Telephone : CENTRAL 3212 (10 lines)
GLASGOW : 116, Hope Street (Central 3970)
BIRMINGHAM : Daimler House, Paradise Street (Midland 0784-5)
THE CHEMICAL AGE offices are closed on Saturdays in accordance with the adoption of the five-day week by Benn Brothers, Limited

VOL. XLIV. NO. 1124 January 11, 1941 Annual Subscription, 21s. Overseas, 26s.

Some Reflections on the Chemical Industry of 1940

THE year that has just passed has been sharply subdivided by the international events of the summer. During the opening months industry was working primarily, though not entirely, on war production but without any particular urgency and under circumstances which, when viewed under present conditions, appear to have been peculiarly happy. With the collapse of France and the air attack on this country an entirely new set of conditions arose. It was realised that the rate of production must attain levels that had not been previously imagined, and upon this was superimposed the difficulties of keeping production moving in the face of periodical air-raid alarms and in some instances of considerable damage to plant and casualties among the personnel. The outlook of the chemist and the chemical engineer upon the events of these last few months depends upon whether he is engaged upon production or upon research. It is safe to say that those engaged in production have done their chemistry with a spanner and have been satisfied to keep the wheels of industry turning as smoothly as may have been possible and to maintain production at the maximum possible level without worrying too greatly about refinements of technique or new developments.

Nevertheless, war, like other activities of mankind, has become scientific and all branches of science are impressed into the prosecution of the war. For this reason scientific research and scientific developments throughout the world have been deeply coloured by the war situation. In the years intervening between 1918 and 1940 the chemists of all nations have done their utmost to make good the deficiencies with which they were faced during the last war. The result has been that most of the warring nations have not been short of essential munitions, as they were in 1914. Germany has realised that upon oil will depend the outcome of the struggle and before the war erected a great many plants for the production of oil from coal; the Nazis will by now have had cause to reflect upon the vulnerability of synthetic oil plants. We do not know fully the extent to which the Germans have been driven to make use of the processes of organic synthesis in the production of foodstuffs and other essentials; but there can be little doubt that the chemists in central Europe are quite as busily occupied as those of this country and America in devising means whereby any deficiencies that may appear in the home front or demands that may be made by the fighting services can be met. There are many who believe that the future of the war will depend upon oil, and that the future of the organic chemical industry of the world will be bound up very largely with the production of a vast range of synthetic chemicals produced from the aliphatic compounds that comprise petroleum. The petroleum chemist has assumed an ever-increasing importance in the world of chemistry during the past few years and there seems every prospect that he will continue to do so. It is to be hoped that after the war a great oil refining industry will spring up in this country to act as the basis not only of liquid fuel production but of this chemical industry.

Another important development of the future should be that of carbide production. The recent commercial production of thiourea from cyanamide in the U.S.A. and the importance which another cyanamide conversion product, melamine, is acquiring in the synthetic resin production both in America and on the Continent foreshadows further industrial developments in the field of cyanamide derivatives. It may well be inferred from this that a home carbide production plant is a necessary part of the chemical equipment of any country possessing a great chemical industry. Before the war there was a great deal of discussion among technologists, and even in Parliament, upon the relative merits of carbide production by water power in Scotland and by steam power in South Wales. This is not the place or the time to disclose anything regarding developments during the war, but while the statement has been made that our carbide stocks are ample for the usual purposes for which carbide is used, the fact remains that we have to import carbide from across the Atlantic and supplies of this material have been disclosed as one of the fundamental requirements for the war-time economy of any country.

Those who have the curiosity to turn back the pages of scientific publications during the past year must inevitably be struck by the increasing conspicuousness of the food chemist. Of all those in the "compartments" into which chemistry is subdivided, the food chemist appears to have been by far the most voluble. Whether this is a temporary phase or not, the fact remains that it reflects accurately the growing importance of this class of chemistry. We have not yet been driven to manufacturing sugar by hydrolysis of wood, a process which is said to be in commercial operation in Germany, but our food chemists are concerned more particularly with the health of the population by rendering available substances in which our present diet is held to be deficient. The great development of vitamin chemistry has probably been responsible for this. Murmurs have been heard to the effect that the present vitamin complex is nothing more than a passing phase which will in due

course give rise to other theories; but whether this be so or not, the fact remains that to-day food chemistry is based upon vitamin chemistry. Considerable controversy has raged over the problem of vitamins in bread. The Ministry of Food appears to be determined to add vitamin B_1 to white flour in order to bring its content of this substance up to that of wholemeal flour, but many eminent food experts are not convinced that this is a right policy. It is believed that many of the ills to which we are subject, such as overtiredness, " nerves," and even laziness, are due to nothing more than deficiencies in our diet.

The provision of aneurin (vitamin B_1) and of other chemicals in concentrated form for food and medicinal purposes is the business of the fine chemical industry. It has been recorded that in America a number of people enter hospital who are well fed by modern standards, yet suffering from famine because of deficiencies in their diet.

Among the substances used in recent years in treating these cases are nicotinic acid, thiamin, riboflavin, pyridoxin, pure vitamin A, ascorbic acid, and adenylic acid. These have been described as the key life-chemicals to combat to-day's dietetic deficiencies which " keep poor men weak, and weak men poor." The fine chemical industry of this country has been built up as a result of our deficiencies of 1914 and it is proving a tower of strength to the country in the present emergency. A large number of products which were imported from abroad can now be replaced by British substitutes. It is difficult to name a single vegetable drug that could not be produced chemically at home or in some part of the Empire; and it is surprising how many old-fashioned drugs manufactured from herbs are in demand in spite of the rapid progress of synthetic chemistry. Agriculture is reawakening in Great Britain and the agricultural chemist has at least as great a part to play as his colleagues in other branches. The home cultivation of many of the plants used in the fine chemical industry might well prove a useful and remunerative undertaking in many parts of the country.

The year has seen a considerable export drive which is regarded by the Government as only one degree less important than the direct production of munitions of war. There are, for example, a Fine Chemical Export Group, a Pharmaceutical Export Group, a Pest Control Chemical Export Group, a Pigment Colour Makers' Export Group, a Dyestuffs Export Group, and a Heavy Chemical Export Group. A Chemical Plant Export Group was inaugurated, but later joined a larger Plant and Oil Export Group as a sub-group. There is little published information regarding the activities of these bodies and their successes or otherwise. The future of this country is closely bound up with the production of goods or substances that require a high degree of skill for their manufacture, and this is pre-eminently a time when British goods of this character can find their way into overseas markets along with American goods, and so create a goodwill serving to counteract the success of the German products which in the past has been due so greatly to Government-subsidised policies that cannot be characterised as fair trading. The British chemical manufacturer and, in most directions also, the British chemical plant manufacturer are fully the equal of their German competitors, and they should be able to capture a reasonable and equitable share of the world's markets for chemicals and chemical plant.

The chemical industry has probably not been greatly affected as yet by the demands of the war for manpower. Within the coming year there will inevitably be made very large additions to our armed forces as we turn from defence to attack. Men will be taken in hundreds of thousands from civil occupations, perhaps even from the munitions industries themselves; yet at the same time production in those industries must be increased. The chemical industry has been concerned during the year with such matters as the Schedule of Reserved Occupations, the deferment of calling-up notices, migration of labour, and similar matters.

There has probably been little direct replacement of male chemical process workers by women. But it is not beyond imagining that this possibility may have to be faced, and although the number of men employed in a chemical process is generally small, experience in the last war showed that the replacement of the unskilled and semi-skilled workers by women even in chemical works is not to be regarded as impracticable or even as difficult. It is of the utmost importance, however, that early steps should be taken to train the new labour force if the managements of the technical staffs are not to be confronted with even greater difficulties than they face at present.

The chemical industry is an international industry. it draws its raw materials from every part of the world and it distributes its manufactured products over an equally wide area. The problem of access to raw materials is of vital importance to this industry, and has served as one excuse for the present war. Reference has already been made to some of the directions in which the totalitarian countries have endeavoured to make themselves self-supporting, in the sure knowledge that they would be inevitably cut off from overseas sources of raw materials as soon as they declared war. The position of Japan is interesting. The large purchases of Mexican mercury by Japan are fresh in memory and it is known that Japanese interest in South America extends to molybdenum, fluorspar, antimony, tungsten, mineral oils, salt, and potash, in all of which she has wholly inadequate domestic resources, but upon the continued availability of which the structure of her now extensive chemical industry largely rests. It has been announced that an ambitious scheme for the production of caustic soda, magnesium, hydrogen, chlorine, and hydrochloric acid from sea water is under consideration. The trend of Japanese industry, a trend which has the wholehearted support of the Japanese Government, is in the directon of the gradual diversion of the industries of that country to those that make use primarily of air, water, and coal as their raw materials. In any review of the international chemical situation these trends in foreign countries should be marked because after the war and when we come to make peace it will be necessary to remove one of the principal sources of international friction, namely, the assumption, wholly incorrect, yet tenaciously held in certain quarters, that the world's raw materials are not open equally to all. Meanwhile, the nation that controls the seas controls the raw materials of the world; and so long as that control is beneficent as at present, it is a guarantee that wanton disturbers of the world's peace cannot escape the consequences of their acts.

New Year Message

from the President of the Institution of Chemical Engineers

Mr. F. Heron Rogers

THOUGH Great Britain was not properly equipped for war, either in trained men for the armed forces or in materials, when the Nazi régime launched its attack in September, 1939, the chemical and allied industries of Great Britain and the Empire were in a much better position for the change-over from peace to war than they were in August, 1914. At the beginning of the war of 1914-18 there was a great scarcity of men with the training and experience necessary in the application of chemical science in industrial operations on a large scale. The seriousness of the defect was recognised by the late Lord Moulton and by others, who in consequence later took steps to encourage the systematic training of "chemical engineers." Lord Moulton's views were well expressed in a lecture which he gave at University College, London, in March, 1920, and which was reprinted in the Transactions of the Institution for 1939.

The improvement in the position in the supply and demand for chemical engineers in the British Empire, and the provision of systematic courses in chemical engineering, are due in no small measure to the work of the Institution, which was formed 18 years ago as a result of the activity of a band of pioneers. The great progress made by the Institution since its formation is largely due to the high standard of training, experience, and professional conduct required from its members.

During the past year the work of the Institution has been directed with the object of doing everything possible to assist the national effort in the present emergency and to prepare to assist in dealing with the problems of peace which are certain to arise when the war is over. There has been no lowering of the standard of qualification required by the Institution; and students have been encouraged to continue their studies so far as is practicable. The announcement that the Institution intended to continue to hold examinations met with a good response in 1940 and an even larger entry has been received for the examination in 1941.

Special degree courses in chemical engineering are available at the University of London (University College and the Imperial College of Science and Technology) and at the College of Technology at Manchester; graduates and post-graduates who successfully complete these courses are exempted from the qualifying examination for Associate-membership of the Institution. Depending upon the subjects successfully taken during the student period, exemption may be either partially or wholly given to applicants from the University of Birmingham, the South Wales and Monmouthshire School of Mines and, in South Africa, the University of Cape Town and the University of the Witwatersrand.

Since the outbreak of war several successful meetings have been held, at which papers of value to the members and to others have been presented. An arrangement has recently been made whereby all the meetings of the Institution and of the Chemical Engineering Group of the Society of Chemical Industry during 1940-1941 will be joint meetings of the two organisations. The great success of the first meeting in December, 1940, under this new arrangement augurs well for 1941. In another direction the Institution has been of assistance to the Central Register of the Ministry of Labour and National Service in selecting chemical engineers for work of national importance requiring special experience.

Last, but not least, reference should be made to the activities of the Graduates' and Students' Section of the Institution. The young men who constitute this section have displayed an initiative and determination to fit themselves for the work ahead, which promises well not only for the profession of chemical engineering but for the nation as a whole.

The New Year opens with a spirit of optimism which could hardly have been expected six months or twelve months ago.

F. HERON ROGERS.

The Chemist in 1940

A Message from the Chairman of the Council of the British Association of Chemists

Mr. A. J. C. Cosbie

I THINK it might now be said, with some degree of justification, that the economic position of the rank and file of chemists is very much better than it was some few years ago. By the term "chemist" I, of course, refer to properly qualified analytical chemists employed in industry generally. The undoubted fact that hitherto the chemist's position in the commercial world was not altogether satisfactory was to some extent the fault of the man himself. Chemists sold their knowledge too cheaply and in many cases failed to impress employers with their appreciation of business difficulties. Many men showed a conspicuous lack of appreciation of the matter of dividend production and showed reluctance towards understanding the point of view of the layman.

After World War No. I industry in this country was ripe for the co-operation of science and indeed the foundation of

the Department of Scientific and Industrial Research was a very striking manifestation of this awakening. Even after the famous "million fund" had been exhausted, industry continued to co-operate with the D.S.I.R. with incalculable benefit to industry and to the community in general.

What happened after the last great war? Very large numbers of young men who thought they were "scientifically minded" or were said to have "leanings" towards a scientific career crowded into the universities and technical colleges. In the course of a few years the market was flooded with variously qualified chemists. The tragedy of the situation was that many of these people became "process chemists" with little or no knowledge of the processes in their larger aspects and no appreciation whatever of the intricacies of the business world. As a result few chemists ever attained executive positions from which they would have been able to appreciate the difficulties of the junior and thus advance his claims with the commercial interests. Again, many young chemists altogether failed to realise the truth of the famous saying "unity is strength" and consequently neglected to band themselves together for their mutual benefit. Instead, they rushed into academic bodies where they could listen to learned papers by eminent colleagues and in time deliver the papers themselves. They seldom seemed to do more than bemoan their unsatisfactory financial status. The British Association of Chemists has worked for years to help those who would not, or could not, help themselves. By giving legal advice on contracts and terms of employment, by circulating lists of vacant posts, by advising both employers and employees on questions of salary and above all by building up an Unemployment Fund of some £22,000 the B.A.C. has helped the junior to "find himself" and to enjoy some measure of independence. If he wishes to change his job to-day or to bargain about his contract or salary he is not faced with a period of unremunerative idleness. The combined effect of these services together with an awakening of the chemist to his own value has undoubtedly helped in the improvement of status in recent years.

In the end, of course, the individual can best help himself by acquiring an appreciation of business methods and by making a real effort to understand the layman and by imparting his knowledge in a digestible form. I have often asked; why must the chemist speak a language of his own? Is it not possible (as in the case of some outstanding examples) to combine chemical erudition and common sense in the same head? I am quite satisfied that until the scientific man appreciates what is meant by "making dividends" and until he can easily impart his knowledge he will gain little success in the world of commerce or even in pure research, where the facility of clear expression is often lacking. Lastly, the chemist should be able to express himself equally on his feet or on paper. How few can do this well!

By these means, more than by waiting for others to help, the young chemist can consolidate his present position and improve it considerably in the future.

A. J. CURTIN COSBIE.

Chemical Trade During 1940

ALTHOUGH many difficulties had to be overcome, trading in chemicals during the past year progressed along steady lines, in fact the markets displayed remarkable stability under abnormal conditions.

In the earlier months of the war the question of maintaining supplies of those chemicals which we are obliged to import was constantly receiving attention. The happenings of 1940, when the resources of France, Scandinavia, and the Low Countries were no longer available, called for a greater measure of control of the chemicals essential for war purposes. Supplies of certain chemicals to consumers for ordinary industrial purposes were drastically curtailed and in some cases entirely withheld, and one or two industries, with no direct part to play in the war effort, have been obliged to utilise substitute materials and investigate other methods of manufacture. This, however, was not the case with the general run of chemicals and on the whole the reasonable requirements of consumers have been met.

It is difficult to give a true picture of overseas trade in chemicals. Imports of chemical products in 1940, according to official statistics, showed an increase of about 20 per cent. over the previous year, but this is by no means a fair comparison because values for most of the imported products rose steeply during the year.

In spite of the loss of the Continental markets the year showed a steady expansion in export trade, particularly to those markets which formerly obtained the greater part of their requirements from Germany and the occupied countries.

So far as British chemicals are concerned there were no rapid advances in values and only a slight upward tendency was noticed in the majority of cases. Such items as finished up substantially dearer on balance for the twelve months include acetic, tartaric and citric acids, acetone, chlorate and hyposulphite of soda, and all the potash products. There were, of course, other price movements too involved to be dealt with in the space of a brief report.

CONTENTS

CONDITIONS IN, AND SOME WAR PROBLEMS OF, THE HEAVY CHEMICAL INDUSTRY IN 1940

By

P. PARRISH, F.I.C., M.I.Chem.E., M.I.Gas E., F.I.I.A.

Mr. P. Parrish

THE year 1940 will long be remembered: the retreat from Dunkirk will be recalled as a glorious episode in the history of the fighting forces of Britain and the Allies, and was aptly described at the time by the Prime Minister as "a miracle of deliverance." Hitler reached what we hope was the zenith of his success on June 16, in the collapse and capitulation of France. In little more than two months Germany had conquered Denmark, Norway, Holland, Belgium, and France. In the following six months only three small countries, Roumania, Hungary and "Slovakia" have been added to the list. The "Neue Ordnung" has failed because neither Madrid nor Moscow was disposed to yield to Berlin's purpose.

The control of many essential materials has been extended during the year by the Ministry of Supply, and now includes sulphate of alumina, potash, paper, chrome ore, magnesite, wolfram, tungsten, sulphur, pyrites, spent oxide, benzol, toluene, industrial ammonia, nitric acid, coal tar products, home-produced dyestuffs, etc. The need for a reduction of imported iron ore, to save shipping, resulted in a call for scrap iron. The chemical industry was in a good position to respond. By reason of the ravages of corrosion, and the policy of keeping in step with the most recent developments in technology, the heavy chemical industry is an important producer of scrap.

The efforts of Germany to establish new and adequate sources and channels of trade and exchange found expression, in the early part of the year, in the sale of patent rights abroad, particularly to America and other neutral countries. It was credibly reported that the patents relating to the manufacture of Buna-type synthetic rubbers had been negotiated.

Utilisation of Waste

The importance of recovering, for re-use in industry, various urgent materials for war purposes, has led to a vigorous campaign in the chemical industry. Barrels, crates, drums and other containers have been collected: old tyres and waste rubber have been reclaimed, and plant for the de-oiling of rags, and for the treatment of waste lubricating oils, have been brought into use. The utilisation of certain by-products which hitherto have only been partially employed, has been urged. Waste pickle liquor may well be treated for the production of sulphate of ammonia, and an active ferric hydrate manufactured, by the method indicated in B.P. 500,193. Burnt spent oxide is now being utilised in the manufacture of gas purifying material.

Bones are being collected and treated: glue is recovered, and the residue used as a constituent of organic fertilisers. Sewage sludge, containing nitrogen, is being prepared as an artificial manure: town refuse is being separated, sifted and fermented, and "Hyganic"—a humus-containing material, peculiarly suitable for the lightening of heavy soils—is in active production.

Heavy leather waste (almost all vegetable-tanned), is produced in boot and shoe factories. Direct use may be made of the leather fibres in waste leather, by incorporating them in leather board, together with such materials as latex, glue, or vegetable fibres. Artificial resins may be introduced. Chrome leather trimmings are extracted with magnesium hydroxide at a *p*H value of 8 to 8.3 (B.P. 338,584). Most of the collagen is extracted by such process, and is worked into glue. The residue, referred to as "scutch," contains chromic oxide, magnesia and residual nitrogenous matter. The increased demand for chromium has renewed interest in the recovery of this material.

Work on other by-products, with a view to their utilisation, is proceeding apace. Plastics as bearing materials may well be used for specific purposes, with the object of conserving certain metals.

No detailed account of the contributions which chemists and other research workers are making towards the national effort can be expected, pending the termination of hostilities. But it is at least encouraging to know from Mr. Morrison, the late Minister of Supply, that the scientific and industrial research departments of his Ministry are doing splendid work. Equally, it is reassuring to know that "proper measures have been taken for the consideration and examination of all proposals of a scientific and inventive character." The President of the Chemical Society has indicated that the original work of research chemists would be needed in the present struggle possibly to a greater extent than in the past.

Exports are of vital importance as a weapon for the prosecution of the war. From a purely British point of view the chief object of exporting is to secure foreign exchange to pay for our imports, and it is thus desirable to export to countries with dollar currencies, or currencies exchangeable into dollars. The chemical industry is fully alive to this necessity, and no stone is being left unturned to achieve the object in view.

Nazi Chemical Gains

With the collapse of Denmark, Norway, Holland, Belgium and France, we were at once deprived, *inter alia*, of our main resources of potash, bauxite and cryolite. With the forcible acquisition of these countries, the Nazis added to their mineral, chemical and other resources in a remarkable way. Their already long list of synthetic ammonia works, of which details were given in last year's review (THE CHEMICAL AGE, *41*, 1070, 431), was extended, and now includes the works shown in the list on the next page. At the same time, the Nazis acquired the rich ironstone deposits of Lorraine, the ammonia-soda works of Norsk-Hydro (Norway), Varangéville, Dombasle, La Madeleine-devant-Nancy, Salin-de-Giraud, etc., as well as many electrolytic caustic soda factories, the Stassfurt potash deposits, the highly-developed collieries and chemical industries of the Staatsmijnen in Limburg, Heerlen, the synthetic ammonia and chemical works of the Dutch Shell Company, the whole of the chemical works and activities of the Union Chimique Belge (the "I.C.I." of Belgium) of the Etablissements Kuhlmann and Saint-Gobain (the "I.C.I." of France), and many important electro-chemical factories, explosives works

SYNTHETIC AMMONIA PRODUCTION.

Location.	Firm.	System.	Annual capacity. Net tons ammonia.	Origin of hydrogen.
Belgium.				
Ostende	Union Chimique Belge, S.A.	Casale	21,250	Coke-oven gas
Selzaete	Etablissements Kuhlmann	Casale and Nitrogen Engineering	19,425	Coke-oven gas and water gas
Tertre	Société Carbochimique	Casale	46,750	Coke-oven gas
La Louvière	S.A.F.E.A.	Casale	23,070	Coke-oven gas
Ougrée	Société Belge de l'Azote	Claude	38,850	Coke-oven gas
Willebrock	Société Evince Coppée	Fauser	12,140	Water gas
France.				
Soulom	Société des Phosphates Tunisiens	Casale	18,210	Electrolysis of water
Toulouse	Office Nationale de l'Azote	Casale	42,490	Water gas
Rouen	Sté. Chimique de la Grande Paroisse	Claude	18,210	Coke-oven gas
Bully-Grenay	Compagnie des Mines de Béthune	Claude	27,315	Coke-oven gas
Lens	Société des Mines de Lens	Mont Cenis	90,000	Coke-oven gas
Waziers	" L'Ammoniaque Synthètique "	Claude	23,675	Coke-oven gas
Fifteen smaller works, manufacturing, say,			104,400	Largely coke-oven gas
Holland.				
Ijmuiden	Mekog (Royal Dutch Shell)	Mont Cenis	19,425	Coke-oven gas.
Limburg	Netherlands Government	Fauser	29,150	Coke-oven gas
Sluiskil	Cie. Néerlandaise de l'Azote (Montecatini)	Fauser	60,600	Coke-oven gas
Norway.				
Notodden	Norsk Hydro-Elektrisk Kvaelstof A/S	Nitrogen Engineering	6,060	Electrolysis of water
Rjukan	Norsk Hydro-Elektrisk Kvaelstof A/S	Haber (I.G.)	97,120	Electrolysis of water

and arsenals. Small wonder, therefore, that this consolidation of potentialities had to be countered by enlisting in an organised way the aid of the chemical and explosives industries of America.

Aluminium

Last year the importance of aluminium was stressed as a raw material of primary importance in the construction of aircraft. The aluminium-producing works of this country carry reasonable stocks of bauxite, but obviously the contraction in the rate of imports was serious for a time, following the armistice signed by Germany and Italy with the Pétain Government. Hitherto the aluminium industry of this country has depended on supplies of bauxite from France, but fortunately it was possible to secure satisfactory deliveries from British and Dutch Guiana and the Netherlands East Indies. Moreover, it is known that adequate quantities of bauxite are available in India, and the existence of commercial deposits in the Mlanje Mountain in Nyasaland has been established. In 1938 the world production of bauxite was just under four million tons.

Cryolite is also of importance in the aluminium industry. Fortunately, there are available to us the natural deposits which exist in Greenland. Cryolite is used to the extent of about 5 per cent. in the production of aluminium. Its purpose is to dissolve the aluminium hydrate, and the current density, temperature and other aspects of control are so regulated that release of the aluminium is largely from the aluminium hydrate, and not from the cryolite. In any case, up to 5 per cent. of cryolite is used, despite all efforts to avoid its electrolytic decomposition.

Synthetic cryolite for the enamel industry is being manufactured by the American Fluoride Corporation. Artificial cryolite can be produced by a fusion process (B.P. 526,921; 1939). One hundred parts of dry pure aluminium fluoride, obtained by treatment of alumina, are intimately mixed with 30 to 35 parts of sodium silicofluoride obtained from hydrofluosilicic acid and a product of the treatment of kaolin, and then slowly introduced into a slightly inclined gas-tight rotatable reaction tube, provided with a connection for leading in the necessary current of inert gas. The reaction tube is heated to a temperature of 450-500° C. and rotated at about two revolutions per minute. After an hour the reaction is complete, and pure, practically silica-free, cryolite is obtained nearly quantitatively. The silicon tetrafluoride released allows of re-use. In other synthetic processes the hydrofluosilic acid which is formed as an aqueous solution in the course of the manufacture of calcium superphoshphate from apatite is employed.

Some High Explosive Problems

Reference was made last year to the concentration of denitrated waste acids in cast iron pots. Further working experience has revealed that improvements are called for in several directions, chief of which is the need for absorbing stresses in the dephlegmators, and the avoidance of movement of the connecting pipe from the pot to the dephlegmator, by reason of the expansion of the refractory brickwork.

High silicon irons are used, among other purposes (a) for pressure absorption of nitric acid vapours, and (b) for certain parts of acid concentrating plants. This question has been actively investigated, and the technique may be improved.

Gas inclusions, with which are associated beads of a phosphide eutectic containing 6 per cent. of phosphorus, have been the subject of lively interest, and while it is known that the presence of phosphorus assists in the pouring of the metal, it seems desirable that the quantity should be limited to say 0.2 per cent. Complete agreement on this aspect, however, does not appear to have been reached.

An interesting survey of high silicon irons has been made by Brian N. Reavell, B.Sc., who has been associated with the manufacture of Tantiron for some time. Many of his observations, particularly those relating to studies of melting methods, merit careful attention; not less so his proposal about constructions combining a cast and welded fabrication. This may well prove to be the solution of many practical works problems.

The advantage of the cast iron pot as a concentrator lies in the production of a crystal-clear C.O.V. This is largely due to the presence of traces of oxidising agent—nitric acid or nitro compounds—and the time contact in the pot. On the other hand, a large bulk of acid is not without its disadvantages. Fig. 1 shows some elements in silicon iron of a bubble-cap tower (dephlegmator) of a sulphuric acid concentration plant, as made by the Audley Engineering Co., Ltd.

Tetryl (tetranitromethyl aniline) is a material that is

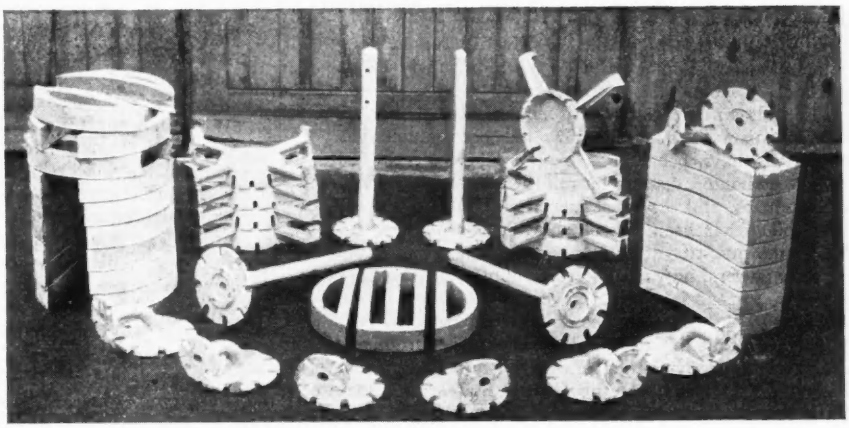


Fig. 1. Elements in silicon iron of a bubble-cap tower, (dephlegmator) of a sulphuric acid concentration plant, manufactured by the Audley Engineering Company, Ltd.

being manufactured by nitrating dimethyl aniline. The spent acid from this manufacture has the following average composition: HNO_3, 10.5 to 11 per cent.; H_2SO_4, 72 to 74 per cent.; H_2O, 11.5 to 12 per cent.; NO_2, 2.4 to 2.5 per cent.; nitro compounds, 0.2 to 0.3 per cent. Usually, crude tetryl, which is unstable, is purified by crystallisation from benzol.

One of the present problems is to reduce shipping to a minimum. This can be effected to an important extent by increasing the production of ammonium sulphate at works where indigenous sulphur materials exist, and releasing by-product ammonia (hitherto fixed as sulphate), as concentrated ammonia liquor, for the manufacture of nitric acid. The sulphuric acid thus set free is available for meeting the increased demands for this mineral acid. In this way the importation of pyrites and sulphur is avoided. The concentrated ammonia liquor required by the Ministry of Supply must comply with the following specification: (a) not less than 25 per cent. of ammonia; (b) chlorine content must not exceed 0.01 per cent.; CO_2 not to exceed 0.10 per cent.; H_2S not to exceed 0.07 per cent.; the solution must be free from drops of oil and from surplus film oil. Coke ovens operating the indirect ammonia recovery process, and many gas works, have been called upon to manufacture concentrated ammonia liquor to the foregoing specification, the suitability of which for conversion to nitric acid is assured.

In these days economy of national expenditure is an overriding consideration. One of the cheapest processes for the manufacture of nitric acid is the combination of plant represented in Fig. 2. Essentially it combines ammonia oxidation, stage 1, with sulphuric acid manufacture, stage 2, and denitration of the excess nitrose (nitrosulphonic acid) for the recovery of nitric acid as stage 3. The oxides of nitrogen leaving the converter of the ammonia oxidation plant are cooled, then passed to a six-compartment reaction—absorption tower. In the first compartment they meet the burner gases from the Glover tower Pyrites are burned, the dust from the burner gases is removed in an electrostatic precipitator, and these enter the Glover tower, which is fed with partially-denitrated acid from the denitrating unit. In the denitrating tower nitrose (nitrosulphonic acid) from the absorbing sections of the hexagonal tower is denitrated with superheated steam, generated in the cooling of the nitrogen oxides leaving the converter. The partially-denitrated acid passes to the Glover tower, where it is completely denitrated, and sulphuric acid is drawn for sale from the foot of this tower, after being cooled.

In the Glover tower 20 per cent. of the SO_2 is converted to sulphuric acid; 78 per cent. in the first compartment of the hexagonal tower; and the balance of 2 per cent. is recovered in the remaining sections. Nitric acid of 60-65 per cent. is discharged from the condenser and absorbing tower, and is ready for use or sale as such, or it can be fortified by the use of sulphuric acid to 96-98 per cent. HNO_3.

A typical installation is one producing the equivalent of 40 tons of monohydrate sulphuric acid per day, and 20 tons of HNO_3 per day, the capital expenditure on which is only about half that of separate sulphuric acid and nitric acid plants.

It is customary to use 2 to 4 gauzes of platinum rhodium (10 per cent.) and platinum iridium (10 per cent.). The latter give a longer lease of life: the oxidation yield as nitric acid is at least 96 per cent.

When sulphuric and nitric acids are manufactured simultaneously, 75 kg. of sulphuric acid per m^3 per 24 hours represents the rate of production, and 100 kg. per m^3 per 24 hours when sulphuric acid alone is made, representing an incredible space-time factor.

What the use of a large excess of N_2O_3 in the reaction zone connotes has never been established. The indications are that the favourable zone for intensive production commences with an excess of N_2O_3, approaching 5 molecules per molecule of SO_2. Temperature influences the speed of reaction. Much more could be said about this fascinating process, but limitations of space preclude further reference.

The Shell Development Company has already begun the erection, at Houston, Texas, of a plant to make 2 million gallons of toluol annually: other petroleum companies are contemplating a similar step. Several methods for the aromatisation of petroleum gases have been described, and the view has been expressed that pyrolysis of normal heptane represents the most promising technique and economic approach.

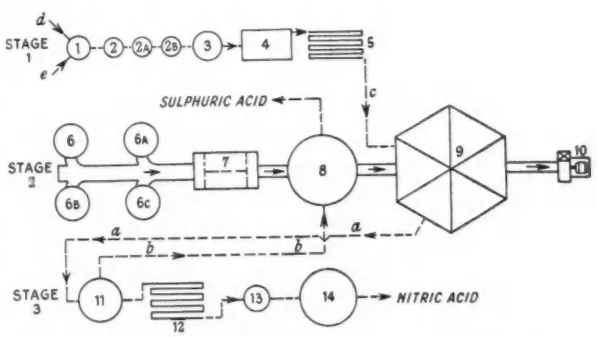


Fig. 2. Combined Sulphuric and Nitric Acid Plant. Kachkaroff-M.P. System

1, Air-ammonia mixer; 2, 2a, 2b, Filters; 3, Converter; 4, Waste heat boiler; 5, Cooler for nitric acid vapours; 6, 6a, 6b, 6c, Pyrites burners; 7, Electrostatic precipitator; 8, Glover tower; 9, Hexagonal reaction tower; 10, Regulus metal fan; 11, Denitrating tower; 12, Cooler; 13, Oxidising tower; 14, Absorption and oxidising tower. (a) "Nitrose" acid; (b) Partially denitrated acid for use at Glover tower; (c) Cooled nitrogen oxides; (d) Air; (e) Ammonia.

Carbon Black and Activated Carbon

Nothing that is calculated to give increased length of life of materials commonly used in this country can be disregarded. Carbon black, owing to its remarkable reinforcing effect, is an essential constituent of most rubbers to-day: the mechanism of its action has not been elucidated. Investigations have been made by the University of Toronto, and it is estimated that by its reinforcing and abrasion-resisting properties, and the consequent lengthening of useful life, carbon black has been instrumental in a reduction of 66 per cent. in the quantity of rubber required in tyre manufacture. The Axis powers, now cut off from supplies of plantation rubber, have, for the last six or seven years, manufactured carbon black by the controlled combustion of crude naphthalene, and later by that of crude anthracene. The product of this method has not proved equal, in rubber mixes, to the material previously imported from the United States, and some concern is felt by the Axis powers on this account.

The demand for activated carbon has continued unabated. New plants have been erected, and the Ministry of Supply has urged the necessity for maximum throughput. Ceylon carbonised coconut shells have been used at some works: their density is 0.68, moisture content 6 per cent., ash content 1.2 per cent. (total alkalis 0.2 mg./gram, and ignition loss, including moisture, about 16 per cent.). Such shells are introduced to retorts: some static, others rotary. The static retorts (Windsor type) are heated by automatically-oil-fired furnaces. "Hysilyn" has proved an excellent refractory material for the construction of the retorts. The temperature of the charge is raised to about 900° C., and superheated steam-air activation in practice gives the best results. Reasonable uniformity of particle size of the carbonised shells to be activated is desirable. There are, of course, volume activity, boiling water extract and hardness tests.

The process or mechanism of rendering carbonised shells highly absorptive, or active, may be regarded as one by which the internal surface of the carbon is very greatly increased. A micro-porous solid should be aimed at, and it is obvious that the combined action of steam and the products of combustion containing oxygen on the surface of the carbon, reacting in addition with the hydrogen constituents of the carbonised shells, constitutes an ideal to be achieved. It has been suggested that one quantity, viz., the "specific surface of the activated carbon—the area of the surface of one gram of the material," would assist in the interpretation of adsorptive phenomena. More fundamental work is still required.

Synthetic Ammonia

United States authorities are at present exercised, in connection with their present military programme, over the question whether synthetic ammonia should be the source of nitric acid, or whether nitrate of soda should be employed. It is remarked that when the present emergency has passed, there may be from 50 to 100 per cent. more capacity for ammonia synthesis in the United States than can be used on peace-time activities. Political considerations apparently enter into the question. It may be necessary to give Chile a market for some of the nitrate of soda which that nation now finds it difficult to sell elsewhere. Clearly, there are "wheels within wheels"; but there is little doubt that the Americans will arrive at a judicious solution of the problem confronting them. An advance of chemical engineering technique in this case may be less important than diplomatic prudence.

Fuel and Gas Industries

The first annual report of the Council of the Gas Research Board is an interesting document: the policy and programme are no less striking than the investigatory work in hand. It is revealed that the work of the Joint Research Committee on the complete gasification of coal has been continued. The possibility of utilising methane as a war-time fuel for motor traction has received consideration.

It has been established that coal and cokes contain only traces of arsenic—usually less than 3 to 4 parts per million. In certain exceptional but important cases 40 to 50 parts per million may be found. The foregoing is important, in that it has been found that sulphuric acid, 70 per cent., can be manufactured from a large number of spent oxides, with not more than 2 to 3 parts of arsenic per million.

Will the exhortation of Mr. Heron Rogers, F.Inst.P., be heeded? In his presidential address to the Institution of Chemical Engineers he examined coal in relation to petrol, and said "a 100,000-ton per annum synthetic oil plant producing all grades requires 550,000 tons of coal." He spoke of the Fischer process, and remarked, significantly, "Synthesis is obviously the only solution. We do not lack brains, inventive energy or courageous finance: moreover, there is a Government bounty in aid." Have chemical engineers blazed a path of new endeavour? What is clogging the wheels of progress? Are not miners out of work? Is not an outlet for increasing quantities of coal being sought?

Sulphur

The utilisation of indigenous sulphur material becomes increasingly important in war time. Wherever possible H_2S should be removed from crude coke-oven gases. Gas undertakings should seek to combine more H_2S as ammonium sulphide in their ammoniacal liquor, thus admitting of the conveyance of ammonia and sulphur simultaneously as concentrated gas liquor. In this way the demand for gas purifying material would be eased, and transport economised.

The recovery of marcasite (coal brasses) from the belts of the collieries of this country should be expedited. It is estimated that 50,000 tons of coal brasses ($\frac{3}{8}$ in. and under) per year will eventually reach the sulphuric acid industry.

Portland cement is in strong demand at the present time. There are large quantities of anhydrite at various strategic points in this country. Anhydrite could be used in the manufacture of Portland cement, and the sulphur dioxide recovered could be converted to sulphuric acid, which is the preferable method, or sulphur could be manufactured.

Reduction of Sulphur Dioxide

R. Lepsoe (Consolidated Mining and Smelting Co., of Canada, Ltd.) has elucidated the mechanism of the reduction of SO_2 by carbon. The reduction can rightly be represented thus:

$$(1)\ SO_2 + C = CO_2 + \tfrac{1}{2}S_2$$
$$(2)\ CO_2 + C = 2CO$$

where the ratio of the apparent reaction constants for the reduction of SO_2 and CO_2 by carbon was 10:1. But as the ratio of the actual observation was only 5:1, it is concluded that a third reaction:—

$$(3)\ SO_2 + 2CO = 2CO_2 + \tfrac{1}{2}S_2$$

occurs as a reaction of the first order at the surface of the coke, with the ash as a catalyst. The publications of Lepsoe should be studied, as also the interesting survey by Dr. D. D. Howat (THE CHEMICAL AGE, 1940, *43*, Nos. 1118-1120), regarding the removal and recovery of sulphur from smelter gases. The whole technique is set out with admirable clarity.

A Canadian Method

The Consolidated Mining and Smelting Co. of Canada, Ltd., have described a method for the production of sulphur from SO_2. Roaster gases are passed through incandescent coke under conditions such as to convert most of the sulphur into carbonyl sulphide (COS); the effluent gases are then cooled, to condense sulphur and impurities, and the residual gas is mixed with clean SO_2—containing gas, and passed over an alumina catalyst. Carbonyl sulphide and SO_2 thus interact, to form pure sulphur, which is condensed. The catalyst is prepared by sintering, at 500-600° C., a mixture of aluminium hydrate, granular fireclay, sawdust and sodium silicate.

The solubility of SO_2 in *o*-toluidine, quinoline and tetrahydronaphthalene has been measured at 18-100° by V. F. Postnikov and T. I. Kunin. For the recovery of SO_2 from exit gases, it is suggested that the most suitable solution is a 1:1 mixture of quinoline and water, but it is uncertain to

what extent the accumulation of SO_3, the formation of which may be fairly rapid, may cause difficulty.

The Germans have extended the gypsum process by the construction of a plant at the Wolfen works of the I.G. The plant is said to be working satisfactorily. It is reported that it has an annual capacity of 80,000 metric tons of sulphuric acid (63,000 tons of SO_3) and 75,000 tons of cement. The Wolfen plant is said to incorporate most of the latest technique, as a result of the operation of the Leverkusen plant.

Thousands of tons of sulphur are being lost at the present time because the SO_2 discharged with the fuel gases from

Fig. 3 (above). Mills-Packard sulphuric acid plant, with split D-shaped tower chambers

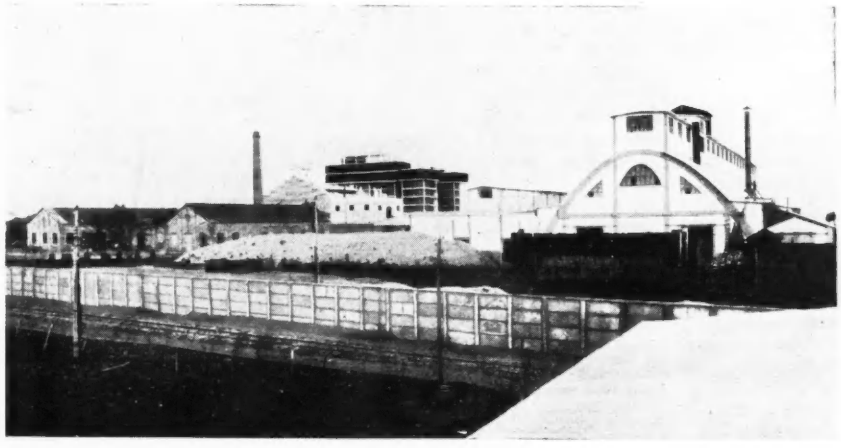


Fig. 4 (right). Gaillard-Parrish liquid phase sulphuric acid plant (tower chambers)

electric power stations is recovered as calcium sulphite-calcium sulphate—a magma of doubtful value.

Flotation ore is now being used to an increasing extent. To reduce the severity of clinkering on the second and third hearths of 20-ton mechanical pyrites burners and the second, third and fourth shelves of 40-ton mechanical furnaces, it is necessary that the following conditions should be observed :—

(1) The provision of larger and wider-spaced cutting rabbles, designed to present a lesser quantity of the flotation ore for oxidation.

(2) Enlargement of the drop-holes from floor to floor.

(3) Notably the adoption of cooling arms in the shelves concerned, in addition to the rabbling arms, and

(4) Minor modifications of draught.

It cannot be doubted that the high sulphur content of flotation pyrites and the rapid volatilisation of the first atom of sulphur are the cause of the incipient fusion which connotes clinkering. This incipient fusion is usually accompanied by the building-up of the ore in front of the rabbles, and unless this condition is arrested, there is always the possibility of arms being broken. Each quality of pyrites requires different handling in mechanical burners, and a change in quality of the ore to be burned calls for careful supervision of the burner during the first two or three days, in order that the precise conditions for efficient combustion may be established. Cyprus flotation ore lends itself to ready combustion, by compliance with the conditions indicated, and the increasing demand speaks well for a quality of pyrites which would have been looked upon askance ten years ago.

This country will shortly be producing practically double the quantity of sulphuric acid (100 per cent.) as compared with the normal pre-war years. It is reported that the German production (C.T.J., 1940, *106*, 2748, 38) has increased from 1,066,700 metric tons in 1934 to a figure approaching 3 million metric tons. The following table gives the ratio of sulphuric acid manufactured by the chamber and contact processes in this country :

Year.	Chamber process	Contact process
1934	75	25
1936	71	29
1938	66	34

What the position in regard to sulphuric acid will be after the war it is difficult to say. It is not unlikely that the quantity of sulphur consumed will be reduced substantially, and there will be an increasing demand for pyrites, because economic considerations will be more dominant than they are to-day. It has yet to be determined that the contact process is the most economical to operate. Even with the best catalyst, the average efficiency of conversion is only 96 per cent., whereas with the chamber process, operating with an exit of 1 grain (using a water-wash tower), the loss represents 1 per cent. In other words, with a plant manufacturing 500 tons of 100 per cent. acid per week, the loss of monohydrate acid is 5 tons. On the other hand, with a contact plant of the same size the loss would be at least 20 tons, representing 4 per cent. loss of monohydrate acid. Assuming monohydrate sulphuric acid to be worth £4 per ton, it is clear that the greater efficiency of the chamber process is tantamount to a saving of £60 per week, or £3120 per year, a not inconsiderable sum and certainly one that cannot be disregarded in these days.

The wet contact process is used by the I.C.I. for the manufacture of sulphuric acid from the effluent gases of a cement kiln, using anhydrite as a component of the charge. After washing the gas to remove dust, it is passed through a basic aluminium sulphate suspension, to remove SO_2. By boiling the absorbing medium, concentrated SO_2 is obtained, and this is converted to SO_3 by the wet contact process, using platinum as the catalyst. The unconverted SO_2 is recovered by passing the gases from the SO_3 absorbers through the SO_2-absorbing medium. This seems an admirable way of increasing the efficiency of conversion.

No one denies the attractiveness of the present form of

oleum plant (contact process): the photographs, Figs. 3 and 4, show respectively (a) a Mills-Packard D-form of tower chamber plant, with Glover and Gay Lussac towers, and burner house, and (b) a Gaillard-Parrish sulphuric acid plant, operated on the liquid phase principle, using tower chambers. These plants are both neat and attractive constructions, admitting of cleanly and ordered operation.

Ammonia and Ammonium Salts

Two interesting processes for the production of ammonium sulphate have been discussed. According to Norsk Hydro (U.S.P. 2,095,074), burner gases containing SO_2 are caused to react wih ammonia in a packed tower to form ammonium sulphite. Oxidation of this salt is effected in solution in another tower by nitrous gases, and the ammonium sulphate solution evaporated under vacuum at 40-50° C. The evaporation is effected by heat exchange from the previous stages. The method adopted by the I.G. (B.P. 511,673) is to oxidise a solution containing ammonia, 100, and SO_2, 290 grams/litre, by subjecting it to a vigorous blast of air in a packed tower. The oxidised product, which contains 15-20 per cent. of SO_4 radical is continuously withdrawn and replaced by fresh liquor, and is finally treated in an autoclave at 8-9 atmospheres at 140-160° C. Ammonium sulphate solution and sulphur are thus produced, and the removal of the latter by filtration can be easily effected.

Macroscopic examination of caked ammonium sulphate shows cementation of minute crystals formed by the absorption and subsequent evaporation of water. The hygroscopicity of commercial ammonium sulphate is much greater than that of the pure salt. The caking tendency could not be correlated with the percentage of voids (cf. Adam). But caked samples contained small and irregular fragile crystals, which were easily broken to fines.

Suggestions are made regarding agitation within the saturator, which is normally considered to be irregular and insufficient. Challis, of the Australian Gaslight and Coke Company, suggests that improvement can be effected by the provision of a central vertical tube with a steam coil at the base. A high steam-ammonia ratio favours the formation of large crystals.

So important is the recovery of gas liquor as concentrated gas liquor at the present time that the Ministry of Supply is favouring assistance for the erection of plants for the manufacture of a product containing 15 to 16 per cent. of ammonia.

Alkali Industry

The extended use of the process for the electrolysis of brine is largely due to improvements in cell design, culminating in the deposited diaphragm cell. This and other factors influencing the economic operation of electrolytic plants are discussed by R. L. Murray (*Chem. Met. Eng.*, 1940, *47*, 396). Experiments have been conducted on a semi-technical scale, with a view to preparing anhydrous caustic soda from a 50 per cent. solution by partial pressure evaporation with paraffin b.p. 180-290° C. Not only is it claimed that a purer product is obtained, at less cost than by the usual process, but it is confidently believed that plant corrosion will be materially reduced, by reason of the protective influence of the paraffin film.

The purification and concentration of electrolytic caustic soda solutions (50 per cent.) by means of ammonia is described in a series of patents by the Pittsburgh Plate Glass Company (B.P. 519,215/6, 519,616). If the caustic soda solution is treated with a 3 : 1 ammonia-water mixture, at about 65° C., two layers separate, the lower one containing less than 0.01 per cent. of sodium chloride, and the upper layer the ammonia-sodium chlorate impurities. By passing the purified caustic soda countercurrent through ammonia-H_2O mixtures of progressively high ammonia concentration by the liquid ammonia under pressure, water is continuously removed into the ammonia layer. Solid caustic soda may be obtained by treating the concentrated solution with five times its volume of liquid ammonia under pressure.

Fertilisers

Potash.—Government foresight in sponsoring measures for accumulating substantial reserves of potash fertilisers in this country before the outbreak of the war has been justified by the events at Dunkirk. Whatever the stocks, the need for rigid economy in use is evident. The emergency has raised questions about the recovery of potash from wool washings, from blast-furnace dust, and from sea water—all of which problems were actively investigated in the last war. The bulk of our present supplies are derived from America and Palestine, but the need for augmenting production from by-product sources is insistent.

Phosphatic.—When an attempt is being made to economise the use of sulphuric acid, it is clearly prudent that the authorities concerned should have regard to the important pronouncement made by Nordengren and Lehrecke in their contribution on "Possible Development of the Superphosphate Industry" (THE CHEMICAL AGE, 1940, *42*, 1080, 139-142). Virtually, the authors declare that water-soluble phosphate spread on the surface of the soil penetrates only 1 to 1½ in. before it is converted into insoluble compounds by the soil constituents, and although the water-soluble P_2O_5 is rendered citrate-soluble, it later becomes citrate-insoluble. A method of avoiding this fixation, which renders ineffective the value of superphosphate as a fertiliser in certain soils, is indicated. It lies in the production of a granular product. Chemical and compound fertilisers are usually made in a granular form, but only small quantities of superphosphate, until recently, have been so produced.

The Sturtevant Engineering Co., Ltd., has covered a sound and economic method for the production of granular superphosphate: indeed, their method is equally applicable to compound fertilisers.

The United States Association of Official Agricultural Chemists has adopted a new definition of superphosphate, which is now regarded as a "commercial phosphate, the phosphoric acid content of which is due chiefly to monocalcium phosphate." The object of this new definition is to permit the production of superphosphate by mixing concentrated phosphoric acid with limestone—a product which lacks the gypsum of ordinary calcium superphosphate.

Development of Cornish Minerals

Crude Colours and Quartz in Active Supply

MESSRS. Shearman and Co (Chemical Products Manufacturing Laboratory), of 2 Bedford Place, Tavistock, Devon, advise us that they are acting as managing agents for their principals, Tamar Valley Minerals, Ltd., and Cornish Ochre Mines, Ltd., who are actively mining in S.W. England, as announced in our columns recently. Messrs. Shearman are processing some of the crude colours (yellow ochres, red oxides of iron, umber) produced by Cornish Ochre Mines, and supplying them in superfine dry ground condition packed in bags, etc., for use in the consuming trades at home and overseas. Among the metalliferous and other minerals now being mined are wolfram, tin concentrates, and arsenical pyrites, as well as white quartz, which is supplied in graded sizes of lumps for use in washing towers, etc. When finely ground the quartz is used as a filtering agent and also for abrasive purposes. Other minerals produced by the Tamar Valley Co. include crude and finely-powdered slate, high-grade feldspar, barytes, chalk, gypsum, and fluorspar.

"Meteorological and other Facts and Data," published by MESSRS. NEGRETTI AND ZAMBRA, 38 Holborn Viaduct, London, E.C.1, proved so popular that they decided to produce a revised edition containing many more interesting and useful scientific meteorological and other facts. This has now appeared under the title of "Scientific Facts and Data."

THE NITROGEN INDUSTRY IN 1940

By

E. B. MAXTED, D.Sc., Ph.D., F.I.C.

Dr. E. B. Maxted

SINCE the first of these annual nitrogen reviews was written in 1919, a fundamental change has taken place in the fixed nitrogen industry. We were at that time, as now, substantially under war conditions, although the 1918 armistice had actually just been signed; but the industry, and particularly the synthesis of ammonia, was then still in a state of active development, and for this reason it was possible to record, in successive annual reviews, a relatively large number of proposals for modifications in ammonia catalysts, in plant and in the general conditions of working. During these 21 years a gradual process of stabilisation has taken place, and the technology of nitrogen fixation has become to a high degree standardised: accordingly, few fresh fundamental modifications have occurred in recent years or are indeed to be expected.

At the present time, the literally enormous fixed nitrogen industry which has been built up since the last war—and which, a few years ago, was faced with the problem of overproduction—assumes an enhanced importance. In this connection it may be noted that the present productive capacity of the axis powers, including that of the countries under their control, has been estimated by J. E. Zanetti (*Ind. Eng. Chem.*, 1940, *42*, 1170) to be 2,529,000 tons of fixed nitrogen a year, this being made up of 2,041,000 tons as synthetic ammonia, 266,000 tons as cyanamide and 222,000 tons as by-product ammonia.

A brief summary of some of the papers and patents, covering developments in this field which have been published since the last of these annual reviews, is contained in the following sections.

Ammonia and Ammonium Salts

S. S. Gauchman and V. A. Reuter (*J. Phys. Chem. Russ.*, 1939, *13*, 593) have correlated the adsorptive properties of two iron-alumina ammonia catalysts for hydrogen and for nitrogen with their relative catalytic activities. As would be expected on grounds of the importance of the nitrogen adsorption in determining the rate of the catalysis, the activated adsorption of this gas, particularly at high temperatures, was far more pronounced on the more active catalyst. A further paper (W. L. Edwards, *Chem. Met. Eng.*, 1939, *46*, 361) deals with the life of catalyst chambers in synthetic ammonia plants. It is, in practice, not difficult to keep the actual pressure-resisting wall relatively cool, by providing an internal heat exchanger around the catalyst chamber proper in such a way that this wall is maintained below the temperature range in which carbon is rapidly removed from steel by hydrogen; but in any case Edwards reports that, in a particular synthetic ammonia plant which was examined after 7½ years use, there were indications that the useful life of the catalyst chamber would be at least 20 years.

As in previous years, several patents and papers have appeared referring to ammonium salts and particularly to ammonium sulphate. Thus the I.G. Farbenindustrie (B.P. 511,673) have described a process for the production of ammonium sulphate and sulphur from aqueous solutions of ammonia and sulphur dioxide. The mixed solutions are oxidised by treatment with a current of air in an oxidation tower system, the oxidised liquid being withdrawn and replaced by fresh liquor. The product obtained from the towers is further treated in an autoclave at about 150° C. An alternative proposal, also for making ammonium sulphate and sulphur from ammonium sulphite, involves the interaction of the sulphite with ammonium bisulphite in the presence of a small quantity of a selenium catalyst (L. L. Kuzmin and V. P. Lozev, *J. Appl. Chem. Russ.*, 1939, *12*, 1775; ex *Brit. Chem. Abs. B*, 1940, 601). The reaction course followed is:

$$(NH_4)_2SO_3 + 2NH_4HSO_3 = 2(NH_4)_2SO_4 + S + H_2O$$

and the process, at 150° C. and with 0.0006 per cent. of selenium, is stated to be complete in about 2 hours. The purification of ammonium sulphate in the saturators has been dealt with by G. Ogden and Imperial Chemical Industries (B.P. 517,374), who have protected a method involving the use of creosote oil, together with a wetting agent such as a sulphonated soap, in order to cause impurities to rise to the surface of the saturator with the object of obtaining colourless sulphate crystals; and, with reference to the production of double sulphates, it may be mentioned that K. J. Jacobi (U.S. P. 2,094,573) has described a method for the manufacture of the double salt $(NH_4)_2SO_4.5K_2SO_4$, by adding ammonium sulphate to a cold solution of potassium chloride.

Nitric Acid and Nitrates

It is well-known that, in the oxidation of ammonia to nitric acid, a slow loss of weight occurs in the platinum gauze catalyst, partly by actual volatilisation and partly by catalytic disintegration. In order to recover this platinum dust, the Hercules Powder Company (B.P. 519,082) propose the provision of filters through which the hot reaction gases pass prior to their condensation. A further method of treatment of the reaction gases has been described by A. Christensen (U.S.P. 2,098,953). In this process the reaction gases are oxidised to nitrogen peroxide by contact with cold nitric acid in a washing tower, the nitrogen peroxide being then removed and further oxidised to acid by scrubbing with dilute nitric acid in the usual way.

Much of the nitric acid made by oxidation of ammonia is converted into ammonium nitrate; and, in connection with this, the Du Pont de Nemours Company (U.S.P. 2,089,945 and 2,089,957) have protected a process of the type in which the heat of neutralisation is used for indirect heating in order to concentrate a previously-made ammonium nitrate solution, the concentration being helped by a current of air. Finally, two patents for the manufacture of sodium nitrate from sodium chloride may be noted. In the first place a process involving the treatment of salt with nitric acid has been described by Imperial Chemical Industries, Ltd. (B.P. 517,174). The sodium nitrate is crystallised out by cooling; and the reaction gases, which contain chlorine, nitrosyl chloride and oxides of nitrogen are—after further treatment with sodium chloride with the object of producing a further amount of sodium nitrate—condensed and separated by fractional distillation. Further modifications in this type of process are due to H. Pauling (B.P. 512,872).

Other Nitrogen Compounds

The production of urea from ammonia and carbon dioxide is of special interest since it offers a means of fixing ammonia without the use of an extraneous acid, carbon dioxide being available in any case as a by-product of the continuous hydrogen process. These gases do not, under manufacturing conditions, usually combine completely; and, in order to recover further quantities of urea and ammonium salts from the unconverted gases, C. K. Lawrence and H. A. Beekhuis (U.S.P. 2,087,325) have evolved a plant for details of which reference should be made to the original specification.

Among other nitrogen compounds, the manufacture of hydrocyanic acid by various methods continues to receive

attention. Thus, A. T. Larson (U.S.P. 2,086,507) recommends a catalyst prepared by fusing manganese dioxide in an oxyhydrogen flame for the production of hydrogen cyanide by the decomposition of formamide at temperatures in the neighbourhood of 600°. The fused manganese dioxide is granulated before use. E. Hene (U.S. P. 2,097,064) has described a process for the manufacture of hydrocyanic acid from ammonium thiocyanate or urea by heating a mixture of these with finely-divided copper, the mixture being heated rapidly up to 350° and then slowly to 600° C. The copper is recovered from the residue by first oxidising this to remove sulphur, followed by the reduction of the copper to metal, which is used again. The removal of hydrogen cyanide from gases containing this has been dealt with by R. W. Millar and H. P. A. Groll (U.S. P. 2,086,731), who employ a scrubbing liquid consisting of an ester or ether of a polyhydric alcohol containing at least three directly coupled carbon atoms such as esters or ethers of 1,3-dihydroxybutane or similar higher glycols.

Finally, further work has been done on the conversion of calcium carbide into calcium cyanamide. The general course of the process in an experimental furnace has been studied by K. Heilmann (*Z. Ver. deut. Ing., Beiheft Verfahrenstech.*, 1939, p. 103; ex *Brit. Chem. Abs, B*, 1940, 441). Details are given of the distribution of temperature through the furnace and of the influence of temperature on the conversion time. It may also be noted that H. H. Frank and W. Kendler (*Z. Elektrochem.*, 1939, *45*, 541) have shown that, although no cyanide can be isolated from the product prepared by treating calcium carbide with nitrogen at atmospheric pressure, the use of higher nitrogen pressures, for instance of the order of 50 atm., leads to the formation of considerable quantities of cyanide from mixtures of calcium carbide with sodium cyanamide, sodium fluoride or sodium chloride. A suitable reaction temperature is 1100° C.

Dr. Louis Light.

DEVELOPMENTS IN COLLOID CHEMISTRY

By

LOUIS LIGHT, M.Sc., Ph.D., A.I.C.

IN the preparation by the stirring method of emulsions of the mayonnaise type with a very high oil content, the highest degree of stability was found by Hall and Dawson to result when an air-film was absent from the system (*Ind. Eng. Chem.*, 1940, *32*, 415-420). This condition is fulfilled when the oil is introduced from below the surface and not, as is usually the case, from above. The technique was tested out in a system containing 3 per cent. fresh egg-yolk as the emulsifying agent, 89-93 per cent. sesame oil and small proportions of vinegar and spice. Discussing the factors that govern the stability of mineral oil emulsion, Schulman and Cockbain (*Trans. Faraday Soc.*, 1940, *36*, 656-68) stress the importance of the electric charge on the interfacial films of emulsifying agent. In experiments with various emulsifying agents it was found that maximum stability was attained in the case of oil-in-water systems when the films of emulsifying agent at the oil/water interfaces were electrically charged and were packed with the maximum number of charged molecules. Minimum interfacial tension is thereby achieved. The conditions are best satisfied by a film containing both an oil-soluble substance (cholesterol) and a larger proportion of an ionisable water-soluble substance (cetyl sodium sulphate). Stability of water-in-oil emulsions, on the other hand, is governed by the presence of interfacial films of emulsifying agent of great rigidity, but deficient in electric charge. A system of this type is formed when water containing digitonin is added to a solution of cholesterol in mineral oil (nujol). Inversion of oil-in-water to water-in-oil emulsions can be effected by taking these relationships into consideration.

The patent literature on emulsifying, foaming, wetting and dispersing agents continues to bear witness to the unceasing flow of new products with stabilising power for various types of colloidal systems, particularly in connection with the textile processing industries. As in recent years, much attention has been given to synthetic organic sulphates, sulphonates and quaternary ammonium compounds. Typical examples are sulphonated derivatives of polyalkylated cyclohexanols (Röhm and Haas Co.; U.S.P. 2,198,375), aromatic sulphonates of high-boiling petroleum fractions (National Aniline and Chemical Co.; U.S.P. 2,196,985), sulphonated derivatives of high-molecular aliphatic hydrocarbons (I.G.; U.S.P. 2,201,944), compounds of the type of sodium abietyl sulphate (Du Pont; U.S.P. 2,203,339), compounds resulting from condensation of a terpene with an aromatic ether followed by sulphonation of an aryl group (Hercules Powder Co.; U.S.P. 2,202,686), sulphates of the type of dimethyl hexadecyl sulphonium methyl sulphate and sulphonates like dimethyl hexadecyl sulphonium *p*-toluene sulphonate (N.V. de Bataafsche Petroleum Maatschappij; Dutch P. 47,897 and 47,715). Derivatives of sulphamic acid, a commercial product of recent development in the United States, have been prepared with good foaming properties by the Du Pont concern (U.S.P. 2,201,762). This patent covers the reaction of an aqueous solution of sulphamic acid with numerous high-molecular aminated compounds, *e.g.*, benzylaminoethyl cellulose, phenol-formaldehyde-alkylamine resin and polymerised *β*-diethylaminoethyl methacrylate. Since the sulphamic radical is easily destroyed, and the emulsifying power with it, by treatment with a reducing agent (sodium nitrite), the new products may also serve under suitable conditions as emulsion breakers.

Among the new quaternary agents are dodecyl dimethyl methallyl ammonium chloride and related compounds, all possessing good foaming properties (Röhm and Haas; U.S.P. 2,191,922). The same firm prepares stable aqueous emulsions of urea-formaldehyde resins with the joint aid of a water-soluble cellulose ether and a quaternary body like benzyl cetyl dimethyl ammonium chloride (U.S.P. 2,196,367).

Deutsche Hydrierwerke (B.P. 515,477) obtain hard-water-stable lathering agents by reacting an aminoaliphatic carboxylic amide (piperidinoacetic acid dodecylamide) with a mineral acid ester (benzyl chloride). I.C.I. (B.P. 523,466) have patented the monohydroxyalkylamides of higher fatty acids and their sulphuric esters as wetting and emulsifying agents. Stable aqueous emulsions of phenol-formaldehyde resins have been prepared with the aid of phenol sulphonic acid-formaldehyde resins as emulsifying agents (Catalin, Ltd.; B.P. 523,222). Among emulsifying agents derived

from natural products which are enjoying an increasing vogue are the tall oil soaps (A. Pollak, *Canadian Chem. and Process Ind.*, 1940, *14*, 398). Tall oil is a by-product of wood-pulp manufacture (one ton of pulp yields about 60 lb. of crude tall oil); its soaps are excellent textile detergents, the sulphonate being used in place of turkey red oil. Tall oil itself finds extensive application in the manufacture of asphalt emulsions. Water-soluble salts of alginic acid (derived from seaweed) continue to enjoy growing popularity in the preparation of colloidal products. This comparatively new British industry may undergo considerable expansion as a result of the development of new textile fibres on the basis of alginates. Another colloid of marine origin which is attracting much attention (in the United States) is chitin, a cellulose-like substance forming part of the structure of shellfish. Experiments described by Thor and Henderson (*Amer. Dyestuffs Reporter*, September 16 and 30, 1940), who used chitin extracted from shrimp waste, indicate the utility of this material in the manufacture of products comparable with ordinary viscose.

Reduction of interfacial tension is not necessarily a measure of detergent power. Dr. M. Dole (*Amer. Dyestuffs Reporter*, 1940, 314) instances the case of cetyl sodium sulphate and cetane sodium sulphonate. These substances reduce interfacial tension to equal extents, but the sulphate possesses twice the detergent power of the sulphonate. Igepon T, again, is not affected in detergent power by the addition of sodium chloride although the latter reduces the interfacial tension.

Emulsion-Breaking Agents

Methods of destroying emulsions have engaged the attention in particular of petroleum producers who are constantly faced with the problem of economical removal of emulsified water from crude oil. These emulsions are generally of the water-in-oil type and the methods evolved are necessarily somewhat empirical owing to variations in the character of the emulsifying agents in different zones. An application of the vibration method of emulsion breaking has been described by the Neon Research Corporation (U.S.P. 2,188,269) who use an argon-neon discharge tube as the vibratory source and run the crude oil through a jacket surrounding the tube so that the vibrations are transmitted directly to the emulsion. The effect is reinforced by packing the jacket with an absorbent such as powdered pumice. Certain plant juices in alkaline solution have been found to break water-in-oil emulsions. Cactus juice has been specified for this purpose by the Kactus Company (U.S.P. 2,191,357). Sap-bearing matter from all plants of the Cactaceæ and Leguminosæ appears to act in the same way (Kactus Co., U.S.P. 2,191,372). Highly complex synthetic demulsifying agents are claimed by the Petrolite Co. in U.S.P. 2,194,643-646 and are based upon reaction between an alkanolamine, a hydroxylated fatty oil and an acidic ester of a polybasic acid.

Polymerisation

The advantages attending the production in emulsified systems of synthetic rubber-like products as well as of other plastic materials are now widely recognised. In Germany the I.G. are building, or have built, new factories for rubbers of the butadiene family on an emulsion basis; in this country the production of neoprene latex (emulsified chlorobutadiene of I.C.I.) is expanding to an encouraging extent. Improvements in the processing of natural rubber latex are also being made and the experience gained in the working of the synthetic latices and that of natural rubber latex is of mutual benefit. The recent patent literature bears witness to the importance of emulsion polymerisation in the production of copolymers of butadiene bodies with other polymerisable substances. The I.G. claim a process for continuous emulsion polymerisation of butadiene in presence of a modifying substance (B.P. 517,051) which indicates a means of speeding up the output of synthetic rubber. I.C.I. have developed the emulsion copolymerisation of cyanobutadiene and butadiene or chlorobutadiene (B.P. 520,022 and 521,545). Emulsifying agents used in butadiene polymerisation reactions include sodium oleate (Du Pont; B.P. 518,057) and salts of isopropyl naphthalene sulphonic acid (I.G.; B.P. 523,130). Among other synthetic products work has been carried out in this country on the emulsion polymerisation of acrylic resins. Copolymerisation of a maleic ester and vinyl chloride is claimed by the I.G. in U.S.P. 2,187,817.

Supersonic Waves and Colloids

Although there is little to indicate how ultra-short waves will eventually be exploited in colloid technology, the activity in this field is instructive. According to Morozov (*Khim. Referat. Zhur.*, *2*, 4, 19; *Amer. Chem. Abstr.*, *1940*, 9210), aqueous emulsion of paraffin wax made by exposure to supersonic vibrations are stable in the absence of an emulsifying agent. Dispersions of indanthrene pigments prepared in a superonic field by Tumanskii and Maksimova (*Colloid J.*, U.S.S.R., 1939, *5*, 517-524) were superior to those made in the ordinary manner in a colloid mill. The setting time of ferric oxide sols exposed to supersonic vibrations has been studied by Sata and Naruse (*Kolloid-Zeitschr.*, 1939, *98*, 341-4), who observed a variation in the effect with the degree of concentration. The vibrations retarded setting in lower concentrations and accelerated it in higher. Schmid and Rommel (*Z. phys. Chem.*, *A185*, 97-139) exposed dilute solutions of synthetic polymers (polystyrene, polyvinyl acetate and polyacrylic esters) to a strong supersonic field and observed reductions in viscosities. The effect was irreversible and presumably the result of rupture of the macromolecules. Pulsation of bubbles as a result of cavitation brought about disintegration of wheat and potato starch paste when exposed to supersonic waves according to S. Ono (*Rev. Phys. Chem.*, Japan, 1940, *14*, 15-41).

The fractional filtration of solution of small colloidal particles can be effected with the aid of regenerated cellulose membranes of graded porosities made by treatment with zinc chloride solutions of various concentrations (Seymour, *J. Biol. Chem.*, 1940, *134*, 701-7). Carborundum filters made with particles of various grain size were used by Amat and Duclaux (*J. Chim. Phys.*, 1939, *30*, 256-262) in filtration of colloidal suspensions of arsenic sulphide, ferric hydroxide and gold, the particle sizes being estimated from the grain size of the carborundum used in a particular filter.

Gloss-Measuring Instrument

Transparency and Colour of Films also Recorded

A NEW apparatus for the measurement of gloss, transparency and colour has been devised at the Indian Lac Research Institute, Namkum, Ranchi. The details of the apparatus and the method of using it have been described in the recently published Bulletin No. 37 of the Institute.

The source of light and the device for measuring the reflected light in this apparatus are located in fixed positions, and they subtend a right angle at the centre of the test surface, which can be rotated so as to vary the angle of incidence. Measurements taken at various angles of incidence, therefore, consist of light values for reflected light at an angle of incidence of 45° as well as diffused light in a direction perpendicular to the incident beam at other angles of incidence. When these light values are plotted against the angles of incidence, curves similar to those obtained with gonio-photometers are obtained. The shape of these curves depends upon the gloss of the test surface. An arrangement for the self-recording of such curves has also been devised by connecting the axis of the test panel with that of a clock or motor-driven drum camera. The procedure for measuring the transparency and colour of varnish films is also described. The chief advantage of the instrument is that it combines three functions in one, and for the measurement of gloss it follows the procedure normally employed in the visual judgment of gloss.

THE PLASTICS INDUSTRY IN 1940

By

HARRY BARRON, Ph.D., B.Sc., A.I.C., A.I.R.I.

Dr. Harry Barron.

THE plastics industry has, of course, been completely dominated by the war situation. The colossal quantities of plastics required for the various services make its importance obvious. This is emphasised by the fact that it is now a controlled industry. During this year a Controller for Plastics has been appointed in the very able personality of Major Vyvyan Board, D.S.O., M.C., of the Distillers Co., Ltd., assisted by a galaxy of plastics experts, including Mr. Merriam of British Xylonite, Ltd., Mr. Delafield of F. A. Hughes, Ltd., and Mr. Glassey of British Industrial Plastics, Ltd. The functions of the control are mainly concerned with supplies of raw materials and their allocation. Since many of our raw materials are imported their use in the present circumstances must be organised in order to obtain maximum benefits and fair distribution.

During the year the development and applications of plastics have necessarily hinged around the service requirements. It is evident that we cannot probe too deeply into the outstanding achievements in these applications. It has been stated in an American journal (*Ind. Eng. Chem.*, News Ed. 18, 1940), that: "A trend of vast purport has been toward the utilisation of plastics by the armed forces of every major nation. Military applications, definite and potential, include laminated materials in airplane construction, cast resins in guide lines on airplane carriers, luminescent resins in various military devices, tinted cellulose acetate windows for air raid protection, gun stocks of cellulose acetate and fabric-filled phenolic resins, cellulose acetate chutes for conveying ammunition belts from boxes to machine guns in airplanes, phenolic mouthpiece and containers for gas masks, impregnation of the fabric of gas masks with vinyl chloride resin as a protection against mustard gas, cellulose acetate in soldier's goggles, phenolic noses of anti-aircraft shells, and the possible application of nylon as a parachute material."

It is interesting to observe that in the above commentary, it was also stated that in 1939 three British Fighting Services already had more than a thousand applications of synthetic resins. The number of uses must now be far in excess of this. The exigencies of the situation have not permitted the introduction of many novelties for general use, whether in the form of raw materials or fabricated articles.

Outstanding Home Features

For my own part, two features in our home industry have impressed me most during the year. The first is the progress of the outstanding British plastic developed in recent years, namely, polymerised ethylene, known as polythene, made by Imperial Chemical Industries, Ltd. It has outstanding electrical properties second only to polystyrene. It is, however, a much more amenable material than the latter. The search for the ideal plasticiser for polystyrene has not yet met with success. While it still holds the premier position as insulating material for moulded articles, it has not widened its field of application. Nevertheless, the production of polystyrene in this country is on the up-grade. Another outstanding feature during the year has been the appearance of polyvinyl chloride plastics based on raw materials produced in this country. This is indeed a great step forward which has long been overdue.

Plastics Developments Abroad

From the grim picture we see in Great Britain, where all our energies are directed to one end, let us turn to developments in the United States where, free from the deadening shackles of war, possessed of unlimited raw materials on the spot, and with the encouragement of a plastics-minded public, progress has been made in leaps and bounds. The major part of this review necessarily deals with changes in the United States industry, which is the focus of plastics activities. Let me hasten to point out that it should be clearly understood that we have participated in some of these developments, although it may not be possible to detail them. There is little information available about German developments, while the up-and-coming French industry has been temporarily blotted out.

Statistics are always interesting since they are a guide to the progress of an industry. So far as this country is concerned, even in peace time, we never have had much in the way of statistics for plastics; obviously, in war time the picture is an even more complete blank. However, once again the United States offers us figures to consider and in many respects these figures do serve as a guide to our own. According to the review for 1939 in *Chem. and Met. Eng.*, February, 1940, the production of phenolic moulding compounds was about 54,000,000 lb. with 30,000,000 lb. used for other purposes. Cast resin production was said to be about 6,000,000 lb. The production of urea-formaldehyde moulding compositions advanced considerably, reaching 14,000,000 lb., while another 1,000,000 lb. of clear resin was used in solution for adhesive laminating purposes, textiles and so on. About 4,000,000 lb. of polystyrene was produced, a considerable increase on previous years. It is certain that this year's figures will far exceed these.

One of the most illuminating statements about plastics activities in the United States has been given in *Modern Plastics*, 1940, *26*, 17. This shows the relative proportions of raw materials used for the major plastics during 1939, as under:—

Phhenolic materials	29%
Cellulose acetate	25.6%
Cellulose nitrate	10.7%
Urea plastics	10.9%
Vinyl plastics	6.7%
Casein plastics	5.3%
Acrylic resins	2.1%
Polystyrene	0.32%

A number of general trends in the United States are of considerable interest. Perhaps the outstanding one of these is the application of plastics to the construction of aircraft. Phenolic resins predominate in this field. There should be no confusion with the use of transparent plastics, which are widely used for accessories such as cockpits, windows, etc. The objective here is the rapid moulding of aeroplanes from plastics, which may eventually supplant the slower riveting and welding from metals, and which may in due course lead to easier mass production methods. Advantages obtained by the use of plastics for such manufacture include low cost of fabrication, high speed of production, high mechanical

strength for a given weight of material and surface smoothness. The best criterion of the importance attached to the idea is the fact that a number of leading aircraft firms in the United States have already invested considerable sums of money in erecting plant for such work.

The principle invariably employed is to use wood veneers as laminations which are bonded together with synthetic resins. The plastic properties of the resins are thereafter used to mould very large sections to the desired shape. These can be very easily assembled. Enormous presses and specially constructed ovens have been made for these purposes. I think it is safe to suggest that what has been done in the United States in this direction is likewise being done to a lesser degree in this country and in Germany.

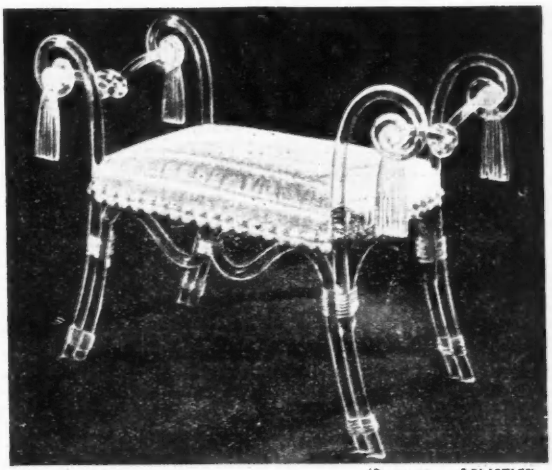
Another spectacular development, unique to the United States, is the production of woven furniture from plastics. One type is based on cellulose acetate butyrate and another is based on ethyl cellulose. The material is extruded in unlimited lengths of any desired cross section. These lengths are cut and subsequently woven in the same manner as cane and rattan chairs. The advantage of such furniture is that the material has low heat conductivity, takes up very little moisture, and is weather resistant. Both types are available in all colours and possess the smooth, sparkling, pleasing surface of the new types of plastics.

Transparent Thermoplastics

The expanding use of transparent thermoplastics for decorative and display illumination purposes is a noteworthy trend in the United States. Unfortunately at the present time there is no scope for such applications here. These applications are responsible for the steeply rising consumption of methyl methacrylate plastics, ethyl cellulose, etc., since these applications require large bulk of material.

The production of laminated glass (the predominating type of safety glass used in the United States) is of major interest to the plastics industry, since it involves the use of a considerable tonnage of plastic. Cellulose acetate had ousted nitrocellulose in this field, and not so long ago held more than 80 per cent. of the market. During this year there was the expected swing over from cellulose acetate to vinyl butyral resin as the plastic in laminated glass. This is virtually standard equipment in the United States car industry. The proportion is now 35 to 65 respectively.

At the moment commercial considerations limit the thickness of the plastic to 0.015 in. During the year it has been shown that an increase in thickness to 0.025 in. doubles the safety factor against impact, through the normal temperature range. The implication of this on potential requirements is obvious.



(By courtesy of PLASTICS)

Fig. 2. A fine example of the type of furniture produced from Lucite and Plexiglas.

It is interesting to consider the influence of current events upon the application of plastics to replace glass in the future. Different types of plastics are being used to an ever growing extent to replace glass for a variety of domestic and commercial purposes. There is no doubt that current experiences will eliminate future sales resistance towards the use of plastics to replace glass. It seems certain that plastics such as cellulose acetate, ethyl cellulose, polyvinyl chloride, and acrylic resins will be used on a very large scale indeed for such purposes. Experience in the United States confirms that this is a natural trend and not due to our own unusual set of circumstances. Plastics are already very widely used for hot and cold bed frames, windows, etc.

Plastics in Coatings

The partial closing of world trade routes has caused a shortage of vegetable oils and the various gums used in the manufacture of coatings. Consequently synthetic resins have found a much wider application in their preparation. This has had a particularly profound effect on the use of alkyd resins, urea-formaldehyde resins, and phenol-formaldehyde resins in the formulation of lacquers and varnishes. Urea-formaldehyde resins in particular have made great strides during the year by virtue of conferring greater hardness, water resistance and durability. A general trend with regard to the use of these is the development of low temperature baking processes. Other plastics which have found

Fig. 1. The Timm trainer plastic aeroplane in flight during trials. The method of production appears to be the shaping, under heat and pressure, of wood veneers probably impregnated with liquid phenolic resin, using expanding rubber moulds heated by hot air.

(By courtesy of PLASTICS)

wider application in the field of coatings include ethyl cellulose (which is incorporated into varnishes and nitrocellulose lacquers), polyvinyl acetals, etc., and acrylic resins.

In addition to their wider use in coatings, urea-formaldehyde resins have made notable advances in their application for adhesives. As a general feature it is noticeable that adhesives, particularly for plywood, are increasingly based on synthetic resins. This is of outstanding interest for aircraft production, but also applies to marine activities, and constructional work generally. The great feature of these adhesives is their resistance to weather which, of course, has always been the main defect of animal and vegetable glues normally used.

Injection Moulding

All the thermoplastics capable of being moulded by injection have found their uses extended considerably by virtue of developments in the injection moulding process. There are now machines available which have capacities of 2½ lb. per shot and which are turning out very large articles, such as car window frames, toilet seats, and so on. Numerous fully automatic injection machines are also operating. Largely because of this the uses for cellulose acetate continue to expand rapidly. New formulations give it lower water absorption and make it able to withstand boiling water for long periods and to resist higher temperatures. In particular the use of injection moulding has had a profound effect on polyvinyl chloride acetate copolymers. Their scope has widely increased. Transparent sheets are also made from this material and are finding a very wide use for such things as drawing instruments, instrument dials, bookbinding leather substitute, and battery separators.

Synthetic Fibres

Outstanding developments of the year must include the progress of synthetic fibres based on plastics. It has been pointed out that while consumption of natural fibres has increased only by 50 per cent. in the last 25 years, consumption of synthetic fibres has increased 750 times. New fibres based on plastics are beginning to make some impression against the viscose threads which is the predominating class. The use of nylon fibres extends by leaps and bounds, and even in this country progress has been made towards manufacture. These polyamide fibres are now commercially available in the United States. They are said to be based on adipic acid and hexamethylenediamine. The bristles are strong, elastic, and uniform in diameter, they do not become brittle or tend to split, and they retain their stiffness over a long period of time. Such fibres are already widely used for full-fashioned hosiery, fish lines, surgical threads, toothbrush bristles, and for various technical processes. Another fibre which continues to develop is vinyon, which is based on polyvinyl chloride acetate copolymers. Introduced for industrial uses as chemical filters, its uses have now extended into more general fields.

Influence of Synthetic Rubbers

It is not fully realised what a profound influence the production of synthetic rubbers has had upon plastics expansion. It is a fact that almost invariably plastic raw materials appear as valuable by-products. There can be no shadow of doubt that manufacture of buna rubbers in Germany is responsible for their large production of polystyrene and of acrylic resins. The remarkable developments during 1940 in synthetic rubber activities in the United States bring this point out very clearly.

Just when the Standard Oil Development Company announced the commercial production of butyl rubber based on butane and acrylic nitrile, the American Cyanamide Company announced the commercial availability of the latter. This is bound to have a stimulating effect on acrylic resins generally. At the same time we learn that butadiene, too, is now available commercially. The Goodrich Co., apparently not content to sit upon the laurels of Koroseal, based on polyvinyl chloride (glibly and incorrectly referred to as a synthetic rubber), have introduced Chemigum. This differs from buna rubbers in that plastic monomers other than styrene and acrylic nitrile are copolymerised with butadiene. Goodyear have come out with Ameripol, based on butadiene and other materials. The Firestone Co. have licences to make buna rubbers. Each of these firms talks about making 10,000 lb. per day, and has already spent a lot of money on plant. In fact for a large rubber firm in the United States not to be making a synthetic rubber is not to be "in the fashion." Apart from the obvious influence on rubber the potential influence on plastics cannot be underestimated.

Conclusion

In conclusion I should like to ventilate one or two grouses which may strike a receptive chord somewhere among the powers that be. Some years ago ethyl cellulose was being made in this country. With singular lack of vision this was abandoned as offering no prospects of a commercial future. Why? It is a remarkably useful and versatile plastic which as I have indicated has already acquired great popularity in the United States.

Once again I should like to point out that a carbide industry (based on coal and lime) would have a profound effect on our plastics development.

Why are we not making (and using) coumarone resins from our more than adequate supplies of coal?

Fig. 3. Raw nylon, bristles manufactured from it, and finished toothbrushes with nylon bristles.

(By courtesy of PLASTICS)

Mr. A. O. Bentley.

PROGRESS IN SYNTHETIC DRUGS AND PHARMACEUTICALS

By

A. O. BENTLEY, Ph.C.

(Reader in Pharmaceutics in the University College of Nottingham)

and

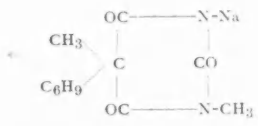
D. H. S. COX, M.P.S.

(Chief Pharmacist to the Nottingham City Hospital)

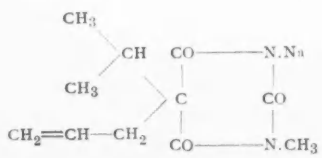
Mr. D. H. S. Cox.

OWING in no small measure to the present war, and to the increasing necessity for the manufacture in this country of chemicals which were previously imported, fewer new pharmaceutical compounds have been introduced during the past year than is usually the case in times of peace. It is good to know, however, that many of these formerly imported pharmaceutical products, the manufacture of which was controlled by foreign patents, are now being made in this country, and that British preparations have proved themselves to be in every way the equal of their foreign prototypes.

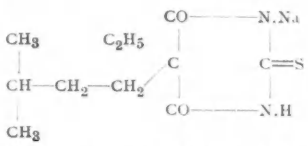
The pre-war demand for these foreign pharmaceuticals was of such magnitude that it became imperative, consequent upon their importation embargo into this country, or upon the natural disinclination of the medical profession to employ drugs of alien origin, that their manufacture should be carried out here. Many of these foreign preparations had undoubtedly established their particular therapeutic efficiency and it was obvious that the demand for products of similar composition would continue. Manufacturing rights were, in consequence, granted to many British firms in order that this continued demand might be met, and, as a result, many recently introduced preparations, the names of which would appear to indicate entirely new products are in reality exact replicas of their foreign precursors. Not in all cases, however, are the British products identical with those of alien origin, since in some instances clinical investigation has shown that some modification of the chemical composition of a compound has resulted in the evolution of a less toxic or more pharmacologically active preparation. The well-known foreign intravenous anæsthetic which had the formula



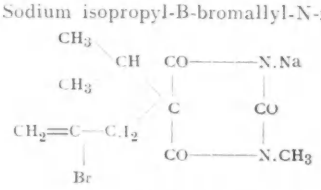
is a typical example of this. The above compound, which is the sodium salt of N-methyl-C-C-cyclo-hexenyl-methyl barbituric acid, is now manufactured in this country, but there are several other equally efficacious preparations, all of British manufacture, which are now available to replace the original foreign product. Each of these is a derivative of barbituric acid, but differs from the original in chemical composition. Three such recently introduced preparations are:—1. The sodium salt of 1-methyl-5:5-allyl-isopropyl-barbituric acid.



2. Sodium ethyl 1-methyl-isoamyl thiobarbiturate.



3. Sodium isopropyl-B-bromallyl-N-methyl barbiturate.

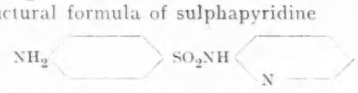


Streptocidal Agents

Since the introduction, in 1937, of chemotherapeutic substances which exerted a specific action on streptococci, much research has been undertaken with a view to synthesising other compounds which might prove equally effective in infections of staphylococcal origin. One of the results of this research was the discovery of the heterocyclic compound 2-(para-aminobenzene sulphonamido) pyridine, known as "Dagenan" or sulphapyridine, which has now fully established itself for the treatment of pneumococcal infections, and has been found to be highly effective in the treatment of gonococcal, meningococcal and a number of other infections.

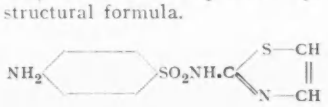
In the course of these chemotherapeutic researches, compounds analogous to sulphapyridine but containing a thiazole or substituted thiazole group in place of the pyridine were later prepared, and experimental clinical tests showed these compounds to be possessed of a low degree of toxicity with a sufficiently high degree of activity to indicate that they might prove effective chemotherapeutic agents. Although the activity of these compounds appeared to be of a lower order than that of sulphapyridine in infections due to pneumococci and haemolytic streptococci, it seemed probable that a greater degree of tolerance or a lesser degree of toxicity might compensate for the former disadvantage and justify the issue of one or more of these compounds as an alternate therapeutic agent.

The structural formula of sulphapyridine



shows that it is related both to sulphanilic acid and aminopyridine and is, therefore, 2-sulphanilyl-aminopyridine.

The recently introduced compound sulphathiazole has the following structural formula.



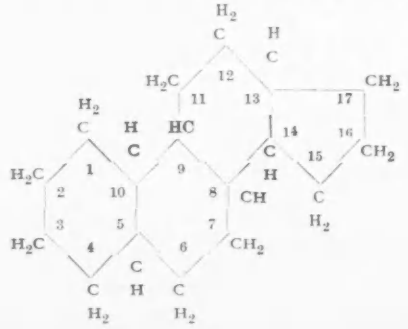
This is 2-(para-aminobenzenesulphonamido) thiazole, which, in its chemical and physical properties closely resembles sulphapyridine. Extensive clinical, pharmacological, bacteriological and chemotherapeutic investigations in America have shown that this compound possesses bacteriostatic properties of advantage over many other sulphonamide derivatives. Its chief advantages in comparison with sulphapyridine are believed to be more uniform absorption, less conjugation after absorption, less tendency to provoke vomiting or nausea, and greater effectiveness against staphylococci.

The 4-methyl and 5-methyl derivatives of this compound have also been studied, as have also the 4-phenyl derivatives, but experimental work has shown that the former are less soluble than sulphathiazole, and the conjugated forms into which they are partially converted in the liver are correspondingly less soluble than the free compound. This would suggest that the therapeutic use of these compounds would involve a correspondingly greater danger of deposition of the acetyl derivatives in the urinary tract.

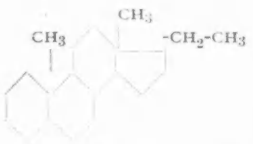
As a guide for dosage requirements and as an added safeguard against severe toxic manifestations, daily estimations of the presence of sulphathiazole in the blood in the free form are recommended. Adequate concentration of the free drug is considered to be from 3 to 6 mg. per 100 cc. of blood. The methods for the biochemical estimation of sulphanilamide and sulphapyridine (devised by Bratton and Marshall in America) have so far appeared quite suitable for the estimation of sulphathiazole. This method is based on the diazotisation of the para-amino-benzene group and the coupling of the diazo compound with N-(1-naphthyl)-ethylenediamine dihydrochloride. A readily soluble purplish coloured azo dye results. The colour intensity is determined colorimetrically by comparison with a solution of pure sulphathiazole as standard.

It has been known for some considerable time that life can be maintained in adrenalectomised animals by the administration of extracts from the adrenal cortex. Crystalline fractions of these cortical extracts were first prepared in America in 1936, and the structural formula of the most active of these compounds, corticosterone, was established in the following year. The synthesis of an even more active compound, desoxycorticosterone, from stigmasterol (a plant sterol found in soya bean) was later reported, and this compound has been since isolated from adrenal tissue. Desoxycorticosterone was found to be much more active than corticosterone, and it was subsequently proved that this activity could be still further increased by esterification with acetic acid. An oily solution of desoxycorticosterone acetate is now manufactured under the name Percorten, and it is computed that 5 mg. of this substance is as potent as 10 mils of cortical extract. Its adoption as more or less routine treatment in Addison's disease and more particularly in the treatment of burns and shock during war time has resulted in the extensive use of desoxycorticosterone acetate in this country.

The cortical hormone and all the sex hormones are relatively simple derivatives of hydrogenated cyclopentanophenanthrene. This also constitutes the nucleus of the sterols (vitamin D, cholesterol, etc.), bile acids, toad poisons, and glucosides of the digitalis groups. The position of each carbon atom in the formula is numbered.



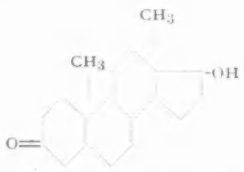
The di-methyl-mono-ethyl derivative of this substance has the following formula



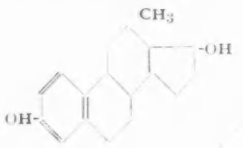
Pregnane

and the chemical relationships between the sex hormones can be shown by their structural formulæ:

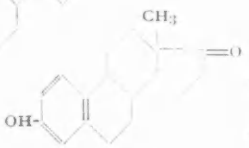
The testis hormone, testosterone, is called androstene-17 trans-ol-3-one.



The female œstrogenic hormones are œstradiol and œstrone.

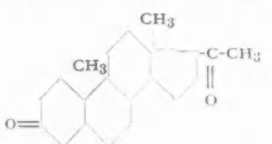


Œstradiol:
$\Delta^{1.3.5}$-œstratriene-3.17-diol



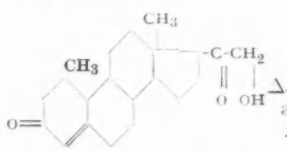
Œstrone:
$\Delta^{1.3.5}$-œstratriene-3-ol-17-one

The corpus luteum hormone is progesterone.



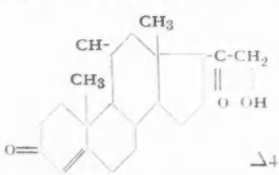
Pregnene-3.10-dione

The most active crystalline adrenal cortex substance is desoxycorticosterone



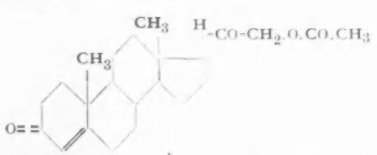
Δ^4-Pregnene-21-ol-3.20-one, also referred to as 21-hydroxy-progesterone.

Whilst the lesser active cortical hormone, corticosterone, is:



Δ^4-Pregnene-17.21-diol-3-3.20-one.

Thus the product desoxycorticosterone acetate (Percorten) has the structural formula:



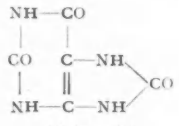
The following prefixes and suffixes have been used in the above formulæ:—

-ol denotes a hydroxy derivative;
hence -diol = 2 hydroxy groups;
-triol = 3 hydroxy groups.
-one denotes a ketone derivative;
hence -dione = 2 keto groups.

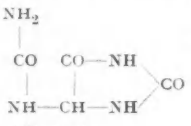
Δ 4 denotes a double bond between C4 and C5.
Δ 5 denotes a double bond between C5 and C6.

Allantoin

Though by no means a recent introduction in medicine, for its properties were first noted centuries ago, the substance allantoin has lately been the subject of further investigation. It is the active principle of comfrey root, *Symphytum officinale*, in which it is present to the extent of 0.8 per cent. Chemically, allantoin is an oxidation product of nucleic acid, and it is a diureide of glyoxylic acid. Its relationship to uric acid is shown by the following formula:



Uric acid



Allantoin

Allantoin is also present in the foetal allantoic fluid and it occurs widely in the animal and vegetable kingdom. It is significant that it is present especially in those parts of plants where active cell multiplication is involved. The embryos of wheat separated in the process of milling contain it. Thus, in its natural state, it is associated with the cell proliferation which is the feature of its therapeutic action.

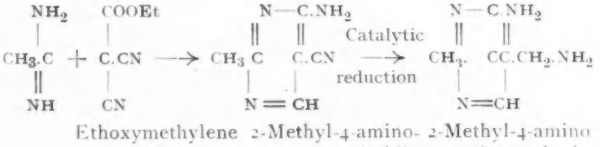
Allantain is now available as a synthetic product and it has been successfully employed in the treatment of ulcerative conditions on account of its cell proliferating action and its stimulating effect on the healing of chronic purulent wounds. It is prepared pharmaceutically as a 0.3 per cent. to 0.4 per cent. aqueous solution of the crystals or as a 3.0 per cent. alcoholic solution, and also as an ointment of 2.0 per cent. with 0.5 per cent. of chlorbutol.

Vitamin B

In view of the possible risks of vitamin B_1 deficiency, especially in the poorer sections of the community among whom white bread is such an important article of diet, it is the intention of the Government to "fortify" white flour with vitamin B_1 and also to add to it a quantity of calcium salt. Before this vitaminised bread can become generally available, the manufacture of vitamin B_1 on a very much larger scale than had hitherto been necessary had to be planned and set in motion. Its production is understood to be in the hands of three firms:—Glaxo Laboratories, Ltd., Roche Products, Ltd., and May and Baker, Ltd. Vitamin B_1, or aneurin was first synthesised in 1936-7 and has a chemical composition of $C_{12}H_{17}N_4SOCl.HCl$. There are three series of patents covering its manufacture and many of the patents cover several possible modifications. The following represents diagrammatically a method of synthesis according to each of the three series.

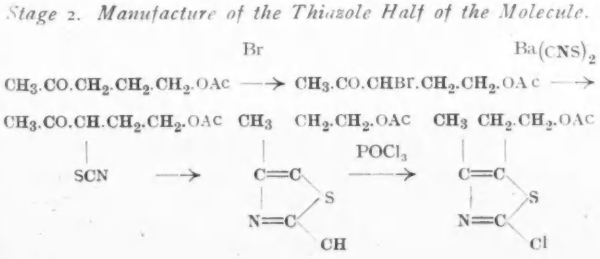
Series A.

Stage 1. *Manufacture of Pyrimidine Half of the Molecule.*

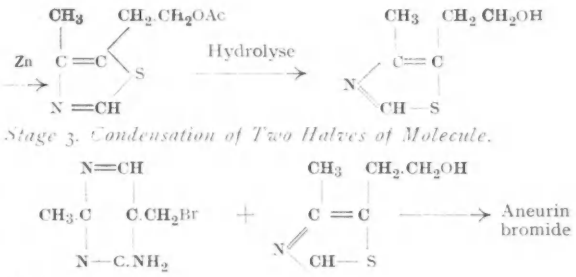


Acetamidine — Ethoxymethylene malonitrile — 2-Methyl-4-amino-5-cyano-pyrimidine — 2-Methyl-4-amino 5-aminomethyl pyrimidine.

Stage 2. *Manufacture of the Thiazole Half of the Molecule.*

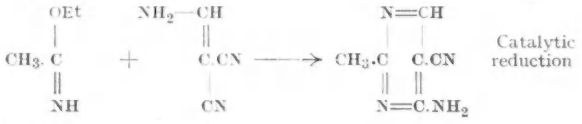


Stage 3. *Condensation of Two Halves of Molecule.*

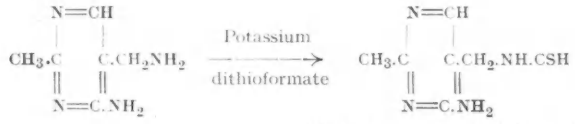


Series B.

Stage 1.

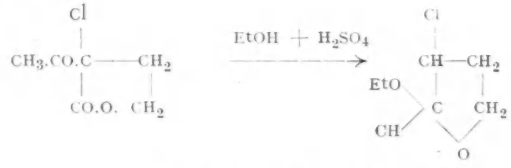


Stage 2.



2-Methyl-4-amino-5-thioformyl-aminomethylpyrimidine (A)

Stage 3.



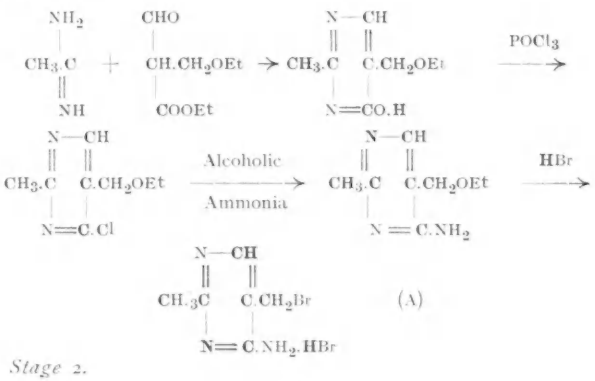
2-Methyl-2-ethoxy-3-chlorotetrahydrofurane (B)

Stage 4.

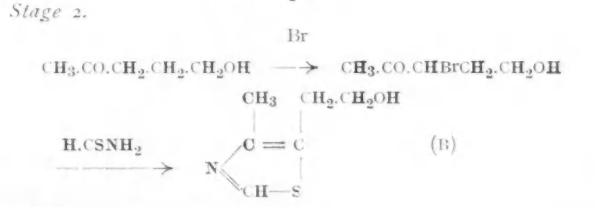
Condensation of (A) and (B) to give aneurin chloride.

Series C.

Stage 1.



Stage 2.



Stage 3.

The condensation of (A) and (B) to give aneurin bromide.

Vitamin D_3

This variety of vitamin D, which is identical with that

(*Continued on page* 36.)

NEWS EVENTS OF 1940

JANUARY

WITH Lord Cadman as chairman, an advisory committee on scientific research and technical development was set up by the Minister of Supply.

* * *

Lord Cadman was appointed honorary adviser on oil by the Secretary of Mines, and Sir Harold Hartley was appointed honorary adviser on the development of home-produced fuels.

* * *

Sir Andrew Rae Duncan, who joined the board of Imperial Chemical Industries, Ltd., in August, 1939, was appointed President of the Board of Trade, his place as Controller of Iron and Steel being taken by Col. Sir W. Charles Wright, chairman of Guest Keen Baldwins Iron and Steel Company and of Baldwins, Ltd.

* * *

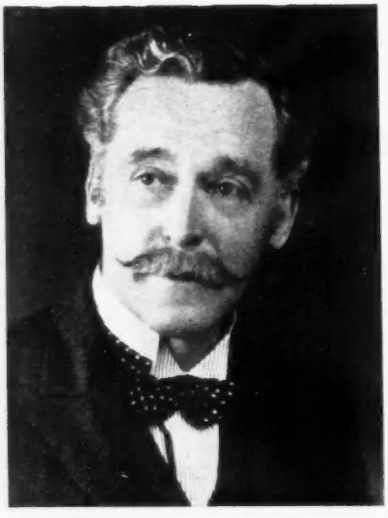
The death occurred of Mr. William Alexander Skeen Calder, F.I.C., M.I.Chem.E., who had been elected president of the Institute of Chemistry the previous March. He was a past president of the Society of Chemical Industry and of the Institution of Chemical Engineers. He had also served on the council of the Chemical Society and at the time of his death was a member of the Industrial Chemistry Committee of the Ministry of Labour.

* * *

It was announced that hundreds of china clay workers in Cornwall and Devon were to receive wage increases of a result of improved trade conditions in the industry.

* * *

Dr. C. Sykes, of the Metropolitan Vickers Research Laboratories, was appointed superintendent of the Department of Metallurgy and Metallurgical Chemistry, National Physical Laboratory, in succession to Dr. C. H. Desch, who retired on December 31, 1939.



The late Professor Sir Gilbert T. Morgan

Regarded as one of the greatest research chemists of the century, Professor Sir Gilbert Thomas Morgan, who was Director of Chemical Research from 1927 to 1938 under the Department of Scientific and Industrial Research, died in hospital at Richmond, Surrey. His work brought him many honours and his services to the country were recognised by his knighthood in 1936.

FEBRUARY

DR. C. H. DESCH was appointed scientific adviser to the Iron and Steel Industrial Council.

* * *

Liverpool University Chemical Society's medal, which is awarded each year to a distinguished man of science who is an old student of the department, was presented to Dr. R. A. Morton.

* * *

As president of the Royal Society, Sir William Bragg undertook the formation of a scientific panel to assist the Press and Censorship Bureau in arranging the censorship of papers in scientific journals.

* * *

Standing as Independent Conservative candidate, Professor A. V. Hill was successful in a Cambridge University by-election.

* * *

Dr. Harry Work Melville, B.Sc., Ph.D., D.Sc., was appointed to the Chair of Chemistry at Aberdeen University.

Dr. J. J. Fox, President of the Institute of Chemistry

At the annual meeting of the Institute of Chemistry, Dr. J. J. Fox, C.B., O.B.E., Government chemist, was elected president in place of the late Mr. W. A. S. Calder. It was stated that the roll of the Institute numbered more than 7,550, this being more than five times as many members as were registered in 1914.

MARCH

THE Society of Public Analysts and Other Analytical Chemists elected Dr. E. B. Hughes as president at the annual meeting. The membership was reported to be 886, a net increase of 29 on the year.

* * *

Lord Dudley was re-elected president of the Parliamentary and Scientific Committee.

* * *

Because of the increased cost of living, the Chemical Workers' Union decided to apply for a 10s. weekly wage increase for men, a 5s. increase for women and proportionate increases for juniors in certain groups.

* * *

The Department of Scientific and Industrial Research opened a new water pollution research laboratory at Watford.

* * *

Sir Harold Carpenter, Professor of Metallurgy at the Royal School of Mines, London, was chosen as winner of the Japan Metallurgy Society's Honda Prize—a gold cup and £300. He was the first foreigner to be so honoured.

The late Sir Jocelyn Thorpe

APRIL

AT the annual meeting of the Institution of Chemical Engineers, Mr. F. Heron Rogers chose the subject of "Oil" for his presidential address. At a luncheon afterwards, a toast to the Institution was proposed by Mr. A. Vyvyan Board, Controller of Molasses and Acetone.

* * *

Lieut.-Col. the Hon. R. M. Preston was elected president of the Institute of Metals.

* * *

In commemoration of his election in 1938 to the Fellowship of the Royal Society and as a token of esteem and admiration, Professor W. E. S. Turner, hon. secretary of the Society of Glass Technology, was presented at the annual meeting with his portrait, painted by Edward I. Halliday, the gift of 400 members and fellows of the society.

MAY

MR. A. MORTIMER was announced as chairman of the newly-formed Pharmaceutical Export Group.

* * *

At the annual meeting of the British Chemical and Dyestuffs Traders' Association, Mr. Victor Blagden was elected president for the ensuing year.

Mr. Victor Blagden, President of British Chemical and Dyestuffs Traders' Association

JUNE

FOUR more Export Groups were formed—one for the scientific instrument trade; one for moulding powder manufacturers; another for moulders, and a fourth for pest control chemicals.

* * *

Mr. J. Davidson Pratt was appointed an additional Deputy Director-General for Chemical Research, Experiment and Development, in the Ministry of Supply.

* * *

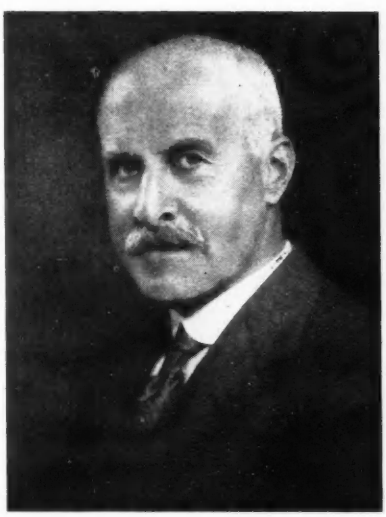
The death occurred of Sir Jocelyn Field Thorpe, one of the most distinguished figures in this country in the world of organic chemistry, particularly in the provinces of dyestuffs and explosives.

* * *

Sir Arthur Harden, who died at the age of 75, was especially distinguished in the biochemical field.

JULY

PROFESSOR J. C. PHILIP was re-appointed president of the Society of Chemical Industry at the annual meeting. Stimulating addresses were given by the President and by Lord Samuel, the year's Messel Medallist. Membership was stated to have increased from 3975 at the end of 1938 to 3997 at the end of 1939.



Professor J. C. Philip, President of the Society of Chemical Industry

The formation of the following Export Groups was announced: fire extinguishers trades; glue, gelatine and allied trades; high conductivity copper and alloys; magnesia; and paint, ink, and allied trades machinery.

* * *

Dr. Max Wyler, who died at Manchester at the age of 69, had been for 33 years a distinguished research chemist in the dyestuffs group of Imperial Chemical Industries, Ltd.

* * *

Mr. W. E. Wornum was elected president of the Oil and Colour Chemists' Association.

AUGUST

IT was reported that 500,000 tons of sugar (white and raw) were produced in 1939 by the British Sugar Corporation from a crop showing the highest yield per acre on record in the United Kingdom.

* * *

Mr. R. T. Holder, Imperial Chemical Industries' representative of Kobe, was one of the prominent British residents detained by the Japanese authorities and subsequently released.

The death, in his ninetieth year, of Sir Oliver Lodge removed from the scientific scene one of the most remarkable figures of the day. In the field of chemical engineering he was best known for his pioneer researches, with Dr. F. G. Cottrell, into electrostatic precipitation.

* * *

Sir Joseph John Thomson, Master of Trinity College and Professor of Physics at Cambridge University, was another great scientist whose death occurred in August.

SEPTEMBER

THE curtailment of imports by the Allied blockade was reported to have caused a considerable shortage of iodine in Germany.

* * *

The Minister of Aircraft Production acknowledged a gift of £20,000 from the staff of Lever Brothers and Unilever, Ltd., and their associated companies, for the purchase of a bomber aeroplane.

* * *

The wages of more than 3000 workers in the Scottish tube manufacturing industry were increased.

* * *

Sir Harold Carpenter, F.R.S., M.A., Ph.D., a metallurgist with an international reputation, who had held the Chair of Metallurgy at the Royal School of Mines, London, for more than 25 years, was found dead in a stream at Clyne Valley, Swansea. A verdict of "Death from asphyxia due to being drowned by falling into a stream following a heart attack" was returned at the inquest.

OCTOBER

SIR ROBERT ABBOTT HADFIELD, Bt., Hon. D.Sc., F.I.C., F.C.S., prominent metallurgical chemist and industrialist, died in his 81st year. It was in connection with the development of manganese steel that his name came prominently to the fore as a metallurgical investigator.

Captain Oliver Lyttelton, President of the Board of Trade

Sir Andrew Rae Duncan vacated the presidency of the Board of Trade to become Minister of Supply in place of Mr. Herbert Morrison, the latter being appointed Home Secretary and Minister of Home Security. Captain Oliver Lyttelton, formerly Controller of Non-Ferrous Metals, became President of the Board of Trade.

* * *

At the annual meeting of the Association of British Chemical Manufacturers, held under the chairmanship of Mr. R. Duncalfe, Mr. E. Wallace was elected president for the ensuing year.

NOVEMBER

MAJOR T. KNOWLES, vice-chairman of the board of Monsanto Chemicals, Ltd., was appointed Controller of Tar Products by the Minister of Mines.

* * *

A Stainless Steel Manufacturers' Export Group was formed, with Mr. C. E. Holmstrom as chairman and Mr. E. J. Gadsby as secretary.

* * *

Several northern chemical concerns were reported to have arranged to give employees extra days off to compensate for war strain.

* * *

It was announced that it had been found possible to dispense entirely with imports of wood charcoal, thanks to improvements in the technique of charcoal-burning in this country.

* * *

A committee was appointed by the Minister of Food to consult with the Ministry on administrative and technical questions arising in connection with the introduction of synthetic vitamin B1 and calcium into white flour.

* * *

Mr. Arthur George Bloxam, F.I.C., who died as a result of enemy action, aged 74, was well known to a wide circle of chemists, industrial and otherwise.

* * *

The inaugural meeting of the British Rheologists' Club, which concerns itself with the flow and deformation properties of materials, was held at Reading.

DECEMBER

IT was announced that Dr. F. M. Lea had been awarded 100 guineas from the Beilby Memorial Fund for his researches on silicate systems and the chemistry of cement.

* * *

Announcement was made of the award of the George Medal to W. T. Beeson, officer in charge, and L. P. Fisher, fireman, both of the works fire brigade at a London chemical works, for their bravery in a fire which resulted from a high-explosive bomb striking a hangar in which combustibles were stored. A few days later a similar award was made to Lieut. J. M. S. Patton, a chemical engineer, for conspicuous gallantry in the safe disposal of an unexploded bomb.

(*Continued from page* 33.)

occurring in cod-liver oil and therefore sometimes referred to as "natural" vitamin D, is now prepared synthetically by the irradiation of 7-dehydrocholesterol giving a "synthetic natural" vitamin D. There has been a certain amount of discussion as to the relative merits of the two forms of vitamin D in man, but it is now almost universally accepted that they are equally effective. (*Lancet*, 1439, 2.876). The provitamin, 7-dehydrocholesterol, is obtained from cholesterol which in turn is a by-product of the extraction of vitamin concentrates from fish-liver oils, or can alternatively be extracted from animal tissues such as brain, spinal cord, etc. Certain British firms have obtained licences under the Emergency Patents legislation for the process of the conversion of cholesterol to 7-dehydrocholesterol. The object of this process is to introduce a double bond between carbon atoms 7 and 8 of the steroid ring system. Cholesterol is treated with acetic anhydride to acetylate and protect the 3-hydroxy group. The product is oxidised with chromic acid to obtain a 7-keto group which is reduced to hydroxyl by means of aluminium isopropylate. The 3-acetyl group is hydrolysed, leaving OH groups in positions 3 and 7. Both the hydroxyl groups are then benzoylated. On heating the product benzoic acid is split off, the benzoyl group coming from position 7, and the H from position 8, thus giving the required double bond. The 3-benzoyl group is removed by hydrolysis. The product is purified, and irradiated in the same way as ergosterol.

NEW APPARATUS IN 1940

A representative selection of the new apparatus placed on the market in 1940 by firms in the chemical and allied industries is illustrated below.

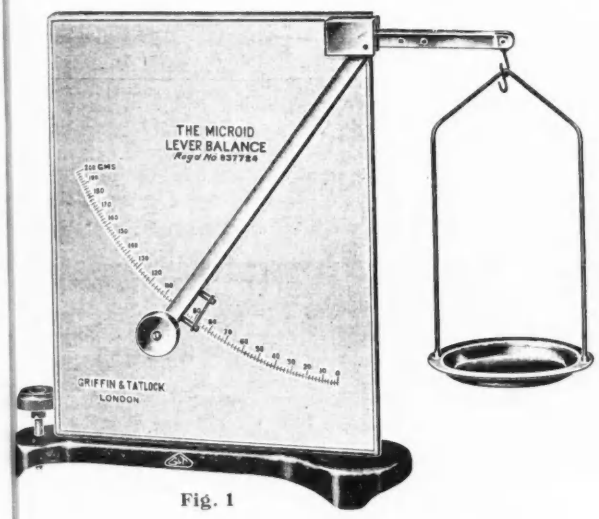


Fig. 1

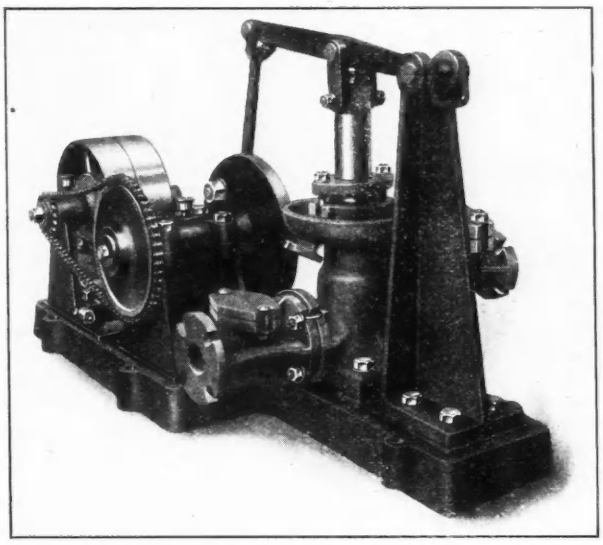


Fig. 2

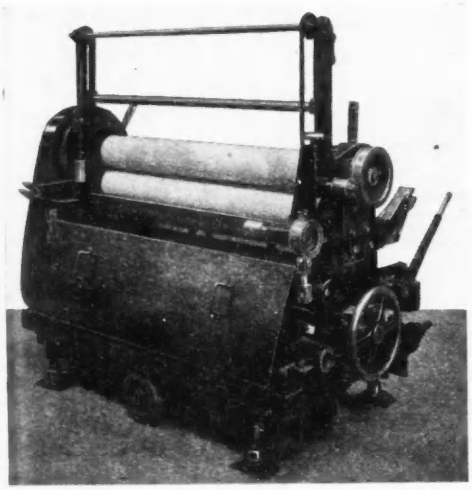


Fig. 3

1. Microid lever balance manufactured by Griffin and Tatlock

2. Single acting plunger type pump manufactured by Meldrum's, Ltd.

3. Light portable padding mangle manufactured by John Dalglish and Sons, Glasgow

4. Constant Temperature Equipment manufactured by the C. L. Burdick Manufacturing Co., Ltd.

5. A Teddington 1-in. thermostatic steam or water valve, manufactured by the British Thermostat Co., Ltd.

6. Distillation equipment constructed in Vitreosil by the Thermal Syndicate, Ltd.

Fig. 4

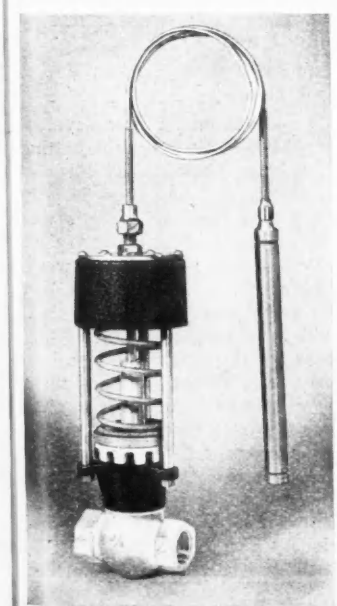


Fig. 5

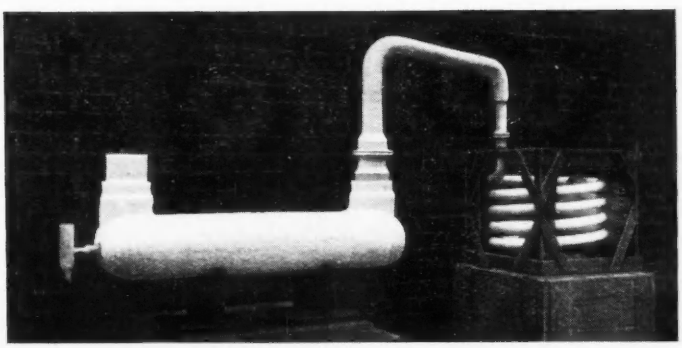


Fig. 6

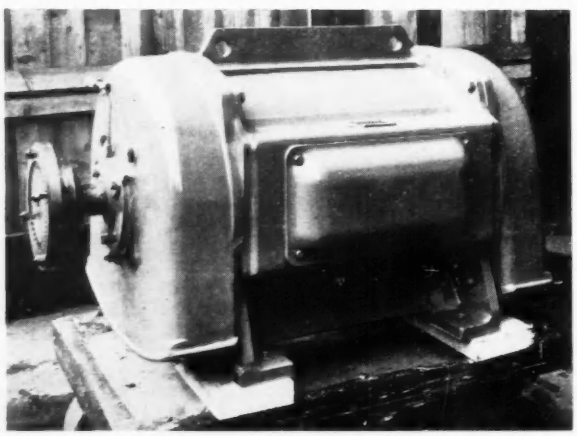
Auxiliary Motors and Control Gear

The Year's Work and Progress Reported by Metrovick

INCREASED activity in the steel industry during the past year has led to large orders for rolling mill auxiliary motors. Metropolitan Vickers report that they have two lines of d.c. steel works motors, each fully standardised, jigged and tooled, the latest line being designed strictly in accordance with the American Iron and Steel Institute's standards. New sizes of these latter machines have been built during the year, with the result that the Company can now supply mill motors from 10 to 150 h.p. strictly interchangeable with motors of American design and rating. During the year, the insulation of the d.c. mill motors has been greatly improved by the substitution of woven glass tapes for asbestos tapes. The glass tape, which is made in this country, is more uniform than asbestos tape, and when used in conjunction with the recently introduced synthetic varnishes has greatly improved electrical characteristics. Investigations carried out during the year have demonstrated that machines can now be built to withstand continuous temperatures which are well in excess of 120° C.

The demand for the "Paradyne" welding set is greater than ever, and it is interesting to note that there is an increasing use of engine-driven welding sets. Orders have been received for both petrol and diesel engine drives, frequently incorporating an air compressor. While portable engine sets are normally mounted on trucks for hand haulage, many sets have been built with pneumatic-tyred trailers suitable for towing behind cars at high speed.

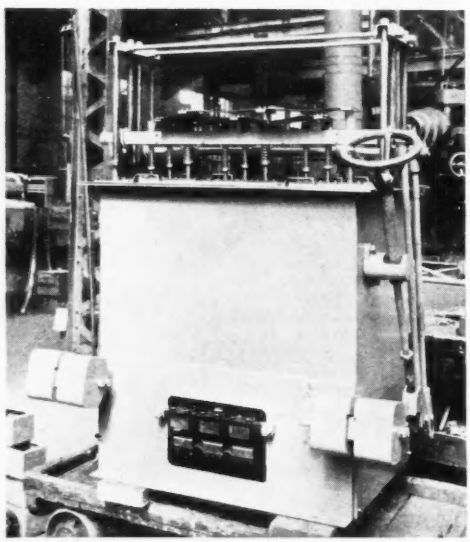
Orders for a.c. motors for industrial purposes have been extremely large in number, but particularly outstanding have been the requirements of the oil refinery industry. Oil refining processes involve the use of a large number of motor driven pumps, compressors, etc. Flameproof squirrel-cage motors suitable for direct starting particularly with low values of starting current, are rapidly being accepted as standard for these drives. The company's line of oil refinery motors now ranges from 2 to 1500 h.p. These machines are designed specifically for the requirements of the industry,



450 h.p., 300 r.p.m., 400 volt squirrel-cage motor for direct starting of a boiler-feed pump.

and are fully certified for Group II gases. A heavy cast iron construction is employed which has the added advantage under the present circumstances of facilitating quicker delivery. As oil refining is a series process, *i.e.*, a breakdown in any part of the plant may cause a complete stoppage, it is of paramount importance that motor drives should be absolutely reliable. With this in view, the F type motors are of very liberal design, employing very large shafts with liberally rated ball and roller bearings in cartridge housings. On the larger motors where occasional inspection of the working parts is desirable, adequate inspection doors are supplied.

The consistent attention which the company has paid to improving the design of motors suitable for high speed centrifugal pumps has been fully justified in that orders for both squirrel-cage and slipring machines have been received in increasing quantities. For some years the company has worked in close co-operation with the leading pump makers with a view to producing a motor drive which is matched



LF 1000 Liquid rotor-starter for slipring motor control

to the pump characteristics. Direct-on starting is now usual on all centrifugal pumps, and motors have been built in sizes up to 1000 h.p. at 3000 r.p.m. The motors can be of the screen protected or totally enclosed fan cooled types and are all designed specially to withstand the large mechanical stresses at starting. Where speed control of the pump is required in order to obtain special output characteristics, slipring motors can be used. During the year slipring motors of 1000 h.p. at 3000 r.p.m., suitable for 15 per cent. speed control, have been delivered.

Control Gear

The last year has naturally seen no major new developments in control gear owing to the necessity of concentrating manufacturing capacity on the more standardised lines of gear. The manufacturing programme has been heavily loaded with all classes of standard types of starters and controllers which have been in great demand for the various manufacturing industries, particularly for machine tool work. In addition there have been many interesting projects calling for the more special types of control gear.

A number of LF 1000 liquid rotor starters has been supplied for use in chemical works for the control of 1900 h.p. slipring motors driving compressors. The starters had to be capable of two starts of ten minutes each per hour against 40 per cent. full load torque and also suitable for running the motor at a low speed at 25 per cent. full load torque for a period of a half-hour.

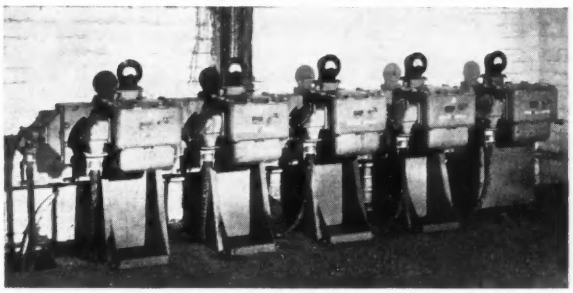
In connection with oil refineries, a prominent feature has been the large number of control boards of the flameproof pattern built up of the various types of air-break (MCD, MSD) and oil-immersed (MOSD, MOCB, MOAT) starters.

These boards usually were complete with interlocked isolating switches and compound filled busbar chambers, for use with both squirrel-cage and slipring motors.

Power House Auxiliaries

A number of additional equipments for boiler house auxiliaries are in hand for two power stations, and for another station some 56 sets of boiler-house contactor cubicles for the rotor control of the induced draught and forced draught fan motors, ranging from 6 to 380 h.p. capacity, have been supplied. Two other boiler-house equipments have been supplied for stations abroad. For the induced draught fan, forced draught fan, and exhauster fan drives the equipments are for the variable speed control of slipring motors by means of motor driven cam-operated contactor controllers. The remaining drives for the pulverisers, mill feeders, screw conveyors are of the contactor direct-on type.

A repeat order for export has been secured for contactor starters, comprising two six-panel boards each for the control of motors varying from 150 to 535 h.p. These contactors are of the oil-immersed type arranged to latch-in and are generally similar to those previously supplied to these clients.



Flameproof control board for oil refineries

Personal Notes

MR. FELIX BERK, managing director of F. W. Berk and Co., Ltd., chemical manufacturers and merchants, Leadenhall Street, E.C.3, was married on January 1, at St. Matthew's Church, Bayswater, to Mary Bain, of 29 Palace Court, London, W.2.

MR. DERMOT J. MOONEY, who has been active in the Nigerian tin mining industry for many years, has been appointed to represent Nigeria on the International Tin Committee in place of Captain Oliver Lyttelton, President of the Board of Trade, who has resigned the committee.

MR. LAURENCE SWADLING, a 21-year-old works chemist of Beddington, Surrey, claims to have invented, according to a report in *The Times*, an aircraft instrument called the milometer, which will enable pilots to tell what ground mileage they have covered. It is to be presumed that the inventor has made due allowance for wind drift, without which the usefulness of the instrument will be limited.

OBITUARY

MR. EDWARD HICKMAN, who died on January 2, at Tettenhall, near Wolverhampton, aged 81, was formerly director and chairman of Alfred Hickman, Ltd., Springvale Furnaces, Bilston, until the firm's amalgamation with Stewarts and Lloyds. He was a former chairman of Tarmac, Ltd., and played a prominent part in the commercial and social activities of the Wolverhampton district.

Fuel Chemistry

Leeds University Special Courses

DETAILS have been issued of a series of special courses in the Department of Coal Gas and Fuel Industries with Metallurgy at the University of Leeds. Beginning on January 27 and ending on February 17, a series of eight lectures on "By-product Coking Processes (Including the Utilisation of Coke Oven Gas for Public Supply)" will be given on Mondays by Mr. T. H. Blakeley, B.Sc., Ph.D., A.I.C., of South Yorkshire Chemical Works, Ltd. "Recent Advances in Refractory Materials" is the subject of a course of four lectures to be given by Mr. A. L. Roberts, Ph.D., on Tuesdays, February 4 and 11, and two lectures on engineering metallurgy will be given by Mr. A. Preece, M.Sc., on February 13, his subject being: "Alloys Used in Aircraft Production." Other lectures will be given on "Preparation and Utilisation of Coal" and "Distribution and Utilisation of Gas." Intending students are invited to send in their names to the Registrar of the University, without delay, specifying what course or courses they wish to attend.

The New Alginate Fibres

Raw Material Supplies

IN continuation of the note published in our issue of December 21 last (Vol. 43, p. 286) we have received further news from a correspondent concerning the new fibres from seaweed. Dr. J. B. Speakman, as we have already reported, found that the heavy metalsalt of alginic acid most suitable for the purposes of textile fibre manufacture was beryllium alginate.

The spinning solution for the new filaments is one of sodium alginate of suitable viscosity; this is spun by the usual rayon machinery, which comprises a gear pump, a "candle" filter, a multi-orifice jet, and a final silk fabric filter. The sodium alginate, forced through the jet, is at once coagulated in the coagulating bath, forming filaments with a number of strands. These are drawn over the usual godet wheel and thence into a centrifugal Topham pot in the form of a yarn composed of soft filaments lightly twisted about one another.

The composition of the coagulating bath determines the main characteristics of the yarn formed. Speakman used a simple solution of calcium chloride at first, later one of slightly acidified calcium chloride which obviated the clogging up of the orifices in the jets. Even so considerable difficulty was experienced owing to the yarns sticking together, a tendency more or less overcome by addition of suitable lubricants to the bath. The rapidity with which the conversion from sodium to calcium alginate takes place is such that a spinning speed of some 30 metres per minute can be attained. Unfortunately, calcium alginate dissolves in warm soap and soda solution, but by treating such yarns with solutions of aluminium or chromium acetate, partial replacement of the calcium by these metals takes place, the yarn being thereby made resistant to such detergent liquors. It is, however, better to use beryllium acetate. This gives a good, colourless yarn with satisfactory strength, which can be dyed with the usual dyestuffs.

One of the leading questions with regard to the new rayon is concerned, of course, with the availability of supplies of the two main raw materials—seaweed, source of the sodium alginate, and beryllium. Expert opinion asserts that very large quantities of seaweed are available, sufficient to maintain an industry comparable in size with the present acetate rayon industry. Beryllium occurs in many minerals, but especially in beryl, a double silicate of beryllium and aluminium, with the formula $3BeO, Al_2O_3, 6SiO_2$, the production of which is being undertaken on an extending scale in Canada (THE CHEMICAL AGE, 1939, *41*, 1063, p. 329). It has been stated that supplies of the metal (used in the form of its acetate) are sufficient and could be produced cheaply enough to allow it to be considered a satisfactory raw material.

General News——From Week to Week

THE TEMPORARY ADDRESS of the Amoa Chemical Company, Ltd., is Coventry Road, Hinckley, Leics. (Tel.: Hinckley 725).

THE MINISTER OF FOOD states that the wholesale price of sugar for manufacturing purposes is increased from January 1, by 9s. 4d. per cwt.

CROFTS (ENGINEERS), LTD., Thornbury, Bradford, have sent us a copy of their 1941 calendar, which contains illustrations of the geared motors and machinery they produce.

THE CLAY INDUSTRIES EXPORT GROUP has been formed, with subsidiary groups for Sanitary Fireclay Goods, Salt-Glazed Pipes and Fittings, and Refractories of all descriptions. The chairman is Mr. Norman Hurtley, the secretary, Mr. H. Halliday, F.C.I.S. The address of the Group is 12 Hartington Road, Buxton, Derbyshire.

THE PAST YEAR HAS ENDED rather seriously for the china-clay industry and although the earlier months of the year saw the trade doing well, hopes for the continuance of normal trade were frustrated by the German occupation of N.W. Europe. Until better conditions can be secured china clay exports must remain very small indeed. There is as much kaolin as ever there was, and production was never in such a state of efficiency, but shipping facilities are lacking. A movement is on foot to send some 200,000 tons to America and it is hoped that the effort will succeed.

Foreign News

IT IS REPORTED that a national textile and a nationl metal syndicate are to be established in Spain.

A SPECIAL COMPANY is to be found in Spain, says Reuter, for the production of chemical fertilisers. It will have a capital of 85,000,000 pesetas (about £2,000,000). Until now, Spain's fertiliser supplies have come almost entirely from abroad.

SHAWINIGAN CHEMICALS, LTD., of Canada, a subsidiary of the Shawinigan Water and Power Co., is extending its drying room and kiln at a cost of $36,340, and spending about $45,000 for a new kiln.

ACCORDING TO MESSAGES from Oslo, quoted by the British United Press, negotiations in which Russia was asking Norway for aluminium in exchange for corn have been broken off, because Norway is already exporting all her aluminium to Germany.

BRITISH COLUMBIA MERCURY PRODUCTION has reached significant amounts, the first shipment from Pinchi Lake amounting to 400 flasks. This was produced in about a month, indicating that Canada may be about to produce four to five times her own requirements in mercury.

TESTS MADE IN VICTORIA, AUSTRALIA, have shown that cars run on a mixture of petrol and eucalyptus extract can cover from three to four miles extra per gallon. Similar experiments have been made in New South Wales, where provisional patents have been taken out.

IRON ORE DISCOVERED on the island of Fyn, Denmark, is as good as the Swedish product, according to the Copenhagen wireless, and the mining of it, which will take place under German instructions, will last for several years. Most of the ore will be shipped to Germany.

THE AMERICAN FRENCH WAR RELIEF ORGANISATION has announced that the British Government has granted the first "navicert" for the transport of 3000 Vitamin B and 10,000 Vitamin A and Vitamin D capsules to France. The consignment was due to leave for Lisbon by Clipper on December 22, en route for the Quaker offices at Marseilles.

THE STATE-OWNED Sulphuric Acid and Superphosphate Mills Co. in Finland has recently announced that it would construct a new sulphuric and hydrochloric acid plant, as well as a sodium sulphate and superphosphate factory at Kokkola, provided that machinery required for the manufacture of these chemicals can be obtained from abroad.

AN ANNOUNCEMENT OF THE ALL-INDIA RADIO states that the Government of India has imposed severe restrictions on the import of aluminium in all forms and from all countries, including the United Kingdom, to prevent any interference with supplies available in the world generally. It was of vital importance, said the announcer, that supplies should be available for the manufacture of aircraft for the British and Allied forces.

EXPORTS OF NITRATE OF SODA from Chile in the first eight months of 1940 totalled 1,152,950 tons, valued at 103,765,700 pesos, compared with 1,055,080 tons, valued at 94,957,000 pesos in the corresponding period of 1939; exports of iodine were valued at 7,216,700 pesos, compared with 4,634,000. Imports of chemicals, oils, paints, etc., were valued at 43,631,600, as against 36,026,900 pesos.

INVESTIGATIONS INTO THE PREPARATION of liquid calciferols for use in artificial cod-liver oil, primarily for meeting Indian Army requirements, have been taken up at the Indian Science Institute, Bangalore. Experiments are also being conducted on steam activation of charcoal, and it is expected that the Institute will be able to supply one ton of activated charcoal daily for the preparation of gas masks.

THE TENNESSEE VALLEY AUTHORITY has announced construction plans for a million-dollar phosphate plant at Godwin Station near Columbia, Tenn., U.S.A. Operations provide for washing and drying of phosphate rock and for sintering of part of the output. The plant, to be completed in less than a year, will have a capacity of 16,000 tons a month and will employ about 100 men.

MORE INTENSIVE USE of the electric furnace in the production of calcium carbide is indicated in an article published in a Russian technical journal. This is inconsistent with a report published some months ago to the effect that the Nitrogen Institute had discovered a new process for manufacturing carbide in an ordinary blast furnace, obtaining as by-products gases suitable for the synthesis of ammonia, methanol and motor fuel, as well as high-grade ferrosilicon.

AN EXPERIMENTAL STATION for studying the growth and cultivation of the carnauba palm is to be established in Brazil under the supervision of the Ministry of Agriculture. This palm, from the leaves of which carnauba wax is extracted, has grown wild and no proper attempts at cultivation have been made. The experimental station will be installed in the State of Piauhy. Production of carnauba wax during the current year is estimated to be more than 13,000 metric tons.

THE WAR SUPPLY BOARD is understood to have authorised the purchase of plant for the manufacture of aero-engine lubricating oil in India. Aviation spirit is already being manufactured from certain Indian and Burman crude oils, from which it can be directly derived. The Burma oils are comparatively rich in constituents suitable for the direct production of aviation spirit. The two countries combined are thirteenth in the world's list of countries producing petroleum.

Forthcoming Events

A JOINT MEETING of the Institution of Chemical Engineers and the Chemical Engineering Group (Society of Chemical Industry) will be held on January 14, 1941, at 2.30 p.m., in the Rooms of the Geological Society, Burlington House, Piccadilly, W.1, when a paper on "Modern Developments in the Design of Plant for the Concentration of Sulphuric Acid," will be presented by Mr. P. Parrish, F.I.C., M.Inst.Gas E. The Chair will be taken by Mr. F. Heron Rogers.

IN THE ROOMS OF the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2, on January 15, at 1.45 p.m., a paper on "Women in Industry" will be read by Miss Caroline Haslett, C.B.E., Adviser to the Ministry of Labour on Women's Training, Director of the Electrical Association for Women, and President of the Women's Engineering Society. Miss Irene Ward, C.B.E., M.P., will preside.

THE THIRD OF A SERIES of meetings in the House of the Pharmaceutical Society of Great Britain, 17 Bloomsbury Square, London, W.C.1, will be held on January 16, at 2.30 p.m. An address entitled "Drug Supplies in War Time" will be given by Mr. A. Mortimer, Secretary of the Wholesale Drug Trade Association and Chairman of the Pharmaceutical Export Group. The lecture will deal with the difficulties of the production and importation of drugs and pharmaceutical chemicals in war time, and a comparison will be made between the conditions applying at the present time and those of the years 1914-1918.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

A. B. METAL PRODUCTS, LTD., Feltham. (M., 11/1/41.) December 10, debenture, to Barclays Bank, Ltd.; securing all moneys due or to become due to the Bank; general charge. *Nil. October 16, 1939.

ANGLO-SCOTTISH PETROLEUM CO., LTD., London, S.E. (M., 11/1/41.) December 12, £1,000 debenture, to W. Christmas, London; general charge. *Nil. Oct. 11, 1939.

NATIONAL FEDERATION OF ASSOCIATED PAINT, COLOUR AND VARNISH MANUFACTURERS OF THE UNITED KINGDOM, London, W.C. (M., 11/1/41.) December 10, £600 charge, to W. Smith, Westcott; charged on Denton, Cotmandene, Dorking. *Nil. December 7, 1939.

SOUTHERN SILICA, LTD., Melksham. (M., 11/1/41.) December 16, £1000 debentures, part of a series already registered. *£12,350 debentures, £3916 bankers. February 7, 1940.

Satisfactions

CHROMOGRAPHIC ENAMEL CO., LTD., London, W.C. (M.S., 11/1/41.) Satisfaction December 20, of mortgage registered August 21, 1939.

Company News

English China Clays, Ltd., announce a preference dividend of 7 per cent. per annum, less tax, for half-year ended December 31, 1940, payable February 1.

South African Alkali, Ltd., report a net profit to June 30 of £3545; to depreciation £2786 (£5568); carried forward £2067 (£1307).

Dussek Bros., Ltd., report, for the year to October last net profits of £24,594 against £25,300. After maintaining the ordinary dividend at 12½ per cent. by a final of 8½ per cent., £16,021 goes forward.

The **Etablissements Saint Gobain** made a net profit in 1939 of 53,100,000 French francs. Of this, 52,000,000 French francs have been put to special emergency reserve, and forward, 1,100,000 francs. Proposed dividend of 16 per cent. will not be paid.

Norsk Hydro announce an ordinary dividend for the year to June 30, 1940, of 6 per cent. (last year, 7 per cent). Owing to exchange restrictions no transfers of dividends payable to foreign shareholders will be made.

New Companies Registered

C. B. Parsons Company, Ltd. (364,374).—Private company. Capital £5000 in 5000 shares of £1 each. Manufacturers of and dealers in soap, chemicals, disinfectants, dyes, drugs, lime, fertilisers, plastics, oil, grease, synthetic products, etc. Directors: John H. Collier, Collinson B. Parsons, James L. Collier. Registered Office: 21 Lower Church Street, Ashby-de-la-Zouch.

Chemical and Allied Stocks and Shares

AIDED by the war news and the further improvement in gilt-edged securities, the general tendency in the stock and share markets has been firm. Restrictions on telephonic communication in the City, however, prevented improvement in the volume of business, although among industrial securities movements in values were in favour of holders. In view of the high level of taxation, the market is not expecting improved dividends from companies connected with the chemical and kindred industries. On the other hand, it is realised that yields at current prices are quite attractive, and if under the lead of gilt-edged stocks, there is a movement to lower yields, chemical and other industrial securities would be expected to participate in any general trend to improved prices.

Imperial Chemical have been more active and made the slightly higher price of 30s. at which the yield works out at over 5¼ per cent.; general expectations are that the dividend total is likely to be kept at 8 per cent. I.C.I. 7 per cent. preference shares at 33s. 3d. have held their recent rise. Turner and Newall attracted attention, awaiting the annual meeting, and as compared with a week ago, have risen from 63s. 9d. to 65s. 7½d. Distillers moved up to 65s. 9d. and there was also better demand for United Molasses, which are 24s. at the time of writing, a rise of 1s. on balance. Dunlop Rubber ordinary units, which according to some market views, may offer the possibility of a small increase in the dividend, were firmer at 32s. 9d. Lever and Unilever participated in the better market trend, and were around 24s., while the 8 per cent. preference units gained a few pence to 25s. 3d. There were few movements among cement shares, but Tunnel Cement were better at 33s. 1½d. British Plaster Board 5s. shares were 11s. 9d., and Associated Cement 58s. 9d. Fison Packard and Prentice were inclined to rally, and changed hands at slightly over 30s. at one time. Cooper McDougall and Robertson £1 ordinary were again quoted around par. B. Laporte have recently transferred between 51s. 3d. and 53s. 1½d., and continued to have a " middle " quotation of 52s. 6d.

Tube Investments attracted rather more attention and were 91s. 3d., while Stewarts and Lloyds improved slightly to 41s. 7½d. Moreover, United Steel were better at 22s., as were Babcock and Wilcox at 39s. 9d., although elsewhere Dorman Long were unchanged at 17s. 6d., and Staveley shares were easier at 42s. 9d. British Glues 4s. shares remained at 6s. 9d. and business in the participating preference shares was recorded at 26s. 4½d. Elsewhere, Morgan Crucible 5 per cent. second preference showed business at 18s. 3d. at one time, while Sanitas Trust 10s. shares transferred at 13s. 9d. Moreover, United Glass Bottle changed hands up to the higher level of 47s., at which only a moderate yield is shown, but this reflects current expectations that the distribution for the year is likely to be kept at 12 per cent. Canning Town Glass 5s. shares were around par, and Triplex Glass 10s. units were quoted at 18s. 6d. British Aluminium were easier at 41s. 3d., but British Oxygen remained steady at 63s. 9d. Pinchin Johnson were better at 19s. 6d.

In other directions Boots Drug 5s. units were steady at the slightly better price of 38s., and Beechams Pills 2s. 6d. deferred shares were firm at 8s. 4½d. Timothy Whites were 19s. 9d., and Sangers 18s. 6d. Borax Consolidated deferred remained at 25s. 7½d. A rather better price of 21s. 6d. was made by Wall Paper Manufacturers deferred units, and Indestructible Paint showed business at 75s. Oil shares have been rather more active under the influence of the " Shell " interim dividend.

British Chemical Prices

Chemical Markets

A GOOD volume of inquiry is reported in nearly all sections of the general chemical market and a firm tone prevails throughout. So far as heavy chemicals are concerned the movement has been on a good scale, the contract renewal business occupying a considerable amount of attention. Values are decidedly firm and a number of prices have been revised, notable advances being recorded for salammoniac fine white crystals and grey galvanising qualities, carbonate of potash, sodium hyposulphite and sodium sulphide. On the whole firm conditions are in evidence in the market for coal tar products and the demand is certainly not less active than during recent weeks. Xylol is quoted dearer, the commercial and pure grades being 3s. 3d. and 3s. 6d. per gallon respectively.

MANCHESTER.—After a certain amount of seasonal slackness during the past week or two business in heavy chemical products on the Manchester market has been resumed on fairly active lines, the principal consuming outlets, including the textile dyeing and finishing trades, calling for good supplies of a wide range of materials. Prices generally are on a very firm basis and the tendency is towards higher levels. In the case of the tar products creosote oil, toluol, xylol, benzol and the naphthas are all meeting with a good demand and quotations are firm.

Price Changes

Ammonium Chloride.—Grey galvanising, £22 10s. per ton in casks, ex wharf.

Naphtha.—Solvent, 90/160°, 1s. 11d. to 2s. 1d. per gal.; heavy 90/190°, 1s. 7d. per gal. naked at works.

Potassium Carbonate.—Hydrated, 83/85%, £47 2s. 6d. per ton; calcined, £54 per ton, c.i.f., U.K. port. Smaller quantities subject to addition to basic price. Spot delivery ex warehouse £3 10s. per ton extra.

Pyridine.—MANCHESTER.—13s. 6d. to 17s. per gal.

Salammoniac.—Fine white crystals, £19 10s. per ton in casks ex store.

Sodium Hyposulphite.—Pea crystals, £19 15s. per ton for 2-ton lots; commercial, £14 10s. MANCHESTER: Commercial, £14 10s.; photographic, £19 15s.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, spot, £16 10s. per ton d/d station in kegs; commercial, £11 15s. per ton d/d station in bags.